DOCUMENT RESUME

ED 222 354 SE 039 404

AUTHOR Nickisch, Marge Hill
TITLE Energy. Nebraska Home Economics Energy Management Guide.
INSTITUTION Nebraska State Energy Office, Lincoln.
PUB DATE 81
NOTE 160p.
AVAILABLE FROM Nebraska Energy Office, Extension Division Chief, P.O. Box 95085, Lincoln, NE 68509 ($12.50).

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Climate Control; *Clothing; Electrical Appliances; *Energy; Energy Conservation; *Family Life; *Food; *Home Economics; *Housing; Learning Activities; Secondary Education
IDENTIFIERS *Energy Education; Energy Management; Nebraska

ABSTRACT

The Nebraska Home Economics Energy Management Guide is composed of 25 individual lessons in 5 units plus a resource section. The introductory unit discusses basic principles in decision-making, the historical development of energy sources and use, and the rationale for energy management. The next four units focus on energy management in housing, foods, clothing, and family living. To help teachers gain the most from the guide, each individual lesson includes: (1) objectives; (2) background information; (3) student activities; (4) resources used in the preparation of the lesson; and (5) suggestions for additional class activities. The resource section includes a bibliography, audio-visual suggestions, and visuals (full page illustrations) suitable for duplication onto paper or for use as overhead projector transparencies. (Author/JN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED222354

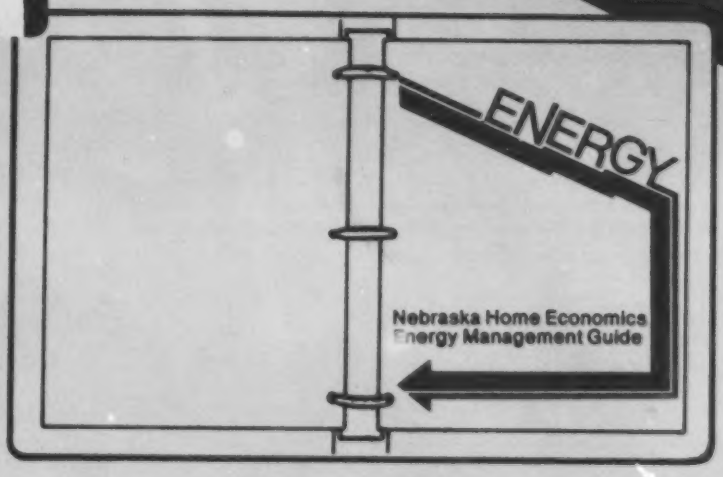
U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

✓ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

ENERGY



"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Gary A. Lay

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

The Nebraska Home Economics Energy Management Guide is designed as a supplement to your Home Economics Curriculum. The Guide includes 25 lessons with background information, activities, ready-to-duplicate visuals and resources on Energy Management. This is all included with an attractive binder and index tabs in a versatile loose-leaf format.

Produced by
The Nebraska Energy Office
P.O. Box 95085
Lincoln, NE 68509

Cost: $12.50 payable to the Nebraska Energy Office.
Contact: Mardel Meinke
Project Coordinator
(402) 471-2867

SE039404

NEBRASKA HOME ECONOMICS ENERGY MANAGEMENT GUIDE

Table of Contents

Foreword

Unit 1— Introduction to Energy Manangement
- Part 1—The need to study energy
- Part 2—Historical perspective of energy
- Part 3—How management fits in

Unit 2— Housing and Home Furnishings
- Lesson 1 Site orientation and landscaping for energy efficiency
- Lesson 2 The energy efficient mobile home
- Lesson 3 Energy efficient apartments
- Lesson 4 Humidity and temperature control
- Lesson 5 Lighting
- Lesson 6 Draperies and window treatments
- Lesson 7 Psychology of room arrangement, color and texture
- Lesson 8 Efficiency through hot water use
- Lesson 9 Efficiency through portable appliances
- Lesson 10 Alternate housing

Unit 3— Foods and Nutrition
- Lesson 1 Appliance labeling
- Lesson 2 Energy management of major appliances
- Lesson 3 Your refrigerator/freezer and energy
- Lesson 4 Microwave ovens
- Lesson 5 Portable kitchen appliances
- Lesson 6 Energy and the food cycle

Unit 4— Clothing and Textiles Unit
- Lesson 1 Basics of thermal comfort
- Lesson 2 Energy efficient wardrobe planning
- Lesson 3 Energy management in the sewing center
- Lesson 4 Energy efficient care of clothing
- Lesson 5 Recycling

Unit 5— Family Living
- Lesson 1 Entertainment
- Lesson 2 Getting into the recycling habit
- Lesson 3 Packaging--and energy
- Lesson 4 Changing life styles

Resources
- Visuals
- Bibliography
- Audio visual suggestions
- Acknowledgements

ENERGY

Written by Marge Hill Nickisch

Design and Illustrations by LaVonne Latham

Produced by
The Nebraska Energy Office
V. B. "Buck" Balok, Director

Mardel K. Meinke, Project Coordinator

NEBRASKA HOME ECONOMICS ENERGY MANAGEMENT GUIDE

The State of Nebraska, Lincoln 1981

The Nebraska Energy Office does not warrant or guarantee any product or practice contained herein as to safety or performance.

This publication has been produced with federal funds disbursed under Public Law 94-163 and Public Law 94-385.

NEBRASKA HOME ECONOMICS ENERGY MANAGEMENT GUIDE

Table of Contents

Foreword

Unit 1— Introduction to Energy Manangement ..... I 1
Part 1—The need to study energy ..... I 1
Part 2—Historical perspective of energy ..... I 4
Part 3—How management fits in ..... I 7

Unit 2— Housing and Home Furnishings ..... HHF 1
Lesson 1 Site orientation and landscaping for energy efficiency ..... HHF 2
Lesson 2 The energy efficient mobile home ..... HHF 7
Lesson 3 Energy efficient apartments ..... HHF 11
Lesson 4 Humidity and temperature control ..... HHF 16
Lesson 5 Lighting ..... HHF 20
Lesson 6 Draperies and window treatments ..... HHF 27
Lesson 7 Psychology of room arrangement, color and texture ..... HHF 32
Lesson 8 Efficiency through hot water use ..... HHF 34
Lesson 9 Efficiency through portable appliances ..... HHF 38
Lesson 10 Alternate housing ..... HHF 42

Unit 3— Foods and Nutrition ..... F 1
Lesson 1 Appliance labeling ..... F 2
Lesson 2 Energy management of major appliances ..... F 10
Lesson 3 Your refrigerator/freezer and energy ..... F 14
Lesson 4 Microwave ovens ..... F 17
Lesson 5 Portable kitchen appliances ..... F 24
Lesson 6 Energy and the food cycle ..... F 29

Unit 4— Clothing and Textiles Unit ..... C 1
Lesson 1 Basics of thermal comfort ..... C 2
Lesson 2 Energy efficient wardrobe planning ..... C 9
Lesson 3 Energy management in the sewing center ..... C 12
Lesson 4 Energy efficient care of clothing ..... C 15
Lesson 5 Recycling ..... C 20

Unit 5— Family Living ..... FL 1
Lesson 1 Entertainment ..... FL 2
Lesson 2 Getting into the recycling habit ..... FL 4
Lesson 3 Packaging--and energy ..... FL 8
Lesson 4 Changing life styles ..... FL 13

Resources ..... R 1
Visuals ..... R 3
Bibliography ..... R 27
Audio visual suggestions ..... R 29
Acknowledgements ..... R 30

FOREWORD

The Nebraska Energy Office hopes this curriculum guide will help you as an educator to integrate energy management principles into your daily classroom activities.

The decision to develop this Guide was made after a 1978 review of the State's Home Economics curriculum showed that energy information was almost non-existent.

In developing this curriculum guide the Nebraska Energy Office has two goals:

1) To provide accurate information on the many aspects of daily home energy management.

2) To provide the information in a format that can be easily incorporated into existing curriculum.

The Nebraska Home Economics Energy Management Guide is composed of 25 individual lessons in five units plus a resource section. The introductory unit discusses basic principles in decision-making, the historical development of energy sources and use, plus the rationale for Energy Management. The next four units focus on energy management in housing, foods, clothing and family living.

To help the teacher gain the most from this guide, each *lesson* includes:

Objectives— what the student is expected to learn

Background Information— primary information is included within the text of the lesson

Activities— to help students meet the given objectives . *These are designated by unit and number.*

Example: HHF # 1 is the first activity in the Housing and Home Furnishings Unit. HHF # 2 is the second activity in that unit, FN#1 is the first activity in the Foods and Nutrition Unit, etc.

Resources— sources used in the preparation of the lesson. Additonal references are listed in the Resource Section.

Suggestions—additional activities for the class

Visuals— full page illustrations related to the lesson. These can be duplicated onto paper or transparencies and are located in the Resource Section of the guide. *Visuals are designated by figure numbers in consecutive order as they appear in the guide.*

Example: Fig. #1 is the first visual, Fig. #2 is the second visual, etc.

Because the energy situation and management techniques are changing constantly, this curriculum guide will be updated periodically. The loose-leaf format should make it easy to insert new information.

Many people should be recognized for their contributions in making this guide possible.

THANK YOU

— William H. Palmer, Former Director of Nebraska Energy Office for believing in the project and approving the appropriation of funds
— Marge Hill Nickisch, project writer, for her special care in researching, writing and organizing the content as well as her invaluable help in working out the many final details
— LaVonne Latham, project illustrator, for her time, talents and exceptional patience
— The Advisory Committee who helped guide us in the right direction.
— The approximately 100 Nebraska vocational home economics teachers who evaluated the units. Their practical suggestions were invaluable.

Additional acknowledgements are given in the resource section.

Contents may be duplicated for use. However, we require that if any part is duplicated, credit be given to the Nebraska Energy Office.

Sincerely,

Mardel K. Meinke

Mardel K. Meinke
Project Coordinator
Nebraska Energy Office

1 Introduction To Energy Management

Part 1: Why Study Energy?

Energy is one basic element of our society to which we have all become so accustomed that we take it for granted. One has only to experience a power outage following a storm to know the frustration of being without those conveniences which have become a part of our way of life.

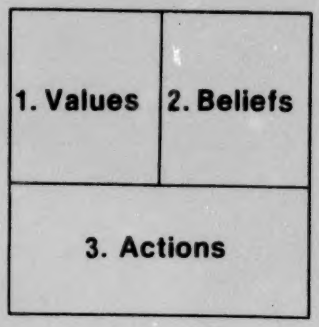
Managing our energy resources—that is, using what we have wisely and planning ahead for future generations—is the subject of the Nebraska Home Economics Energy Management Guide. As professionals in Home Economics we are in a unique position to help students, homemakers and families examine their energy-using habits, and to help them meet tomorrow's energy challenges. It is for you, the Home Economics teacher in Nebraska, that this Guide has been developed.

To accomplish our objectives we need to know a great deal about the energy situation and about ourselves. Energy can be considered a "people" problem; we are the people who use so much of it, the crucial link to conservation and the development and support of new energy resources. We have increased our wants over the years so that they far exceed our needs, and in so doing have become the largest consumers of energy in the world. A Harvard University study estimates that people in the United States could consume 30-40 percent less energy than they do now and still maintain the same (or higher) standard of living.

The People Who Use Energy . . .

For most people, today's energy situation is a big problem—one that is hard to comprehend, almost overwhelming. The energy situation is multi-faceted, complex and far-reaching in scope. For the non-expert, average consumer it is indeed a mind boggling, even frightening, situation.

The average energy consumer has difficulty understanding why we should be concerned about energy when we see so many inconsistencies in everyday living. We have difficulty accepting a request to lower the thermostat setting in winter, for instance, if we walk into a department store to find employees in short sleeves and comfortably warm. A request to restrict driving is questioned when one finds a neighbor or peer using a car excessively and wastefully.



To the average energy consumer, life is full of injustices. Inconsistencies in energy use only add to the frustration. It can be our goal as educators to help these energy consumers feel a desire to manage our resources more wisely rather than to feel they are being asked to sacrifice. **As leaders in energy management we need to understand that certain attitudes and values must be reassessed.**

This "Attitude" Business . . .

Attitudes are, according to Webster's Dictionary, a manner of acting, feeling or thinking that shows one's disposition and opinion. For our purposes an attitude provides a frame of reference in the search for meaning in our world. To a large extent, it determines our behavior, and it is this behavior which educators often seek to influence.

Before we talk more about behavior, let's look at the components of an attitude. While some psychologists might disagree, we can set up a system which works for us. We can say that any given attitude seems to have three components:

1) **Values**. These are one's basic convictions. One feels that certain things are true, good or desirable. Values are, in many ways, subjective.
2) **Beliefs**. These are "facts" which we claim to know or what we have learned. They are the "objective" element in the attitude.
3) The **Action Tendency**. This is the tendency or likelihood to act in a given situation. Whether or not one acts is based upon many factors—personality, the peer group, probability of effect, intensity of feeling, and so on.

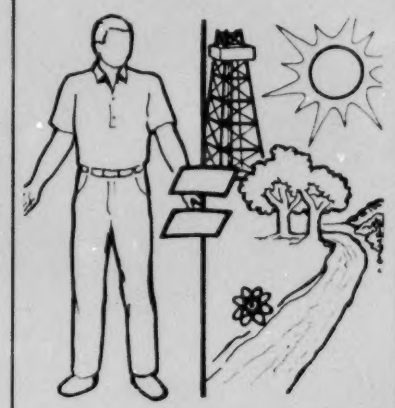
In most instances these three components affect one another. That which one values determines courses of action. For example, if one attends college (a course of action) one will probably acquire other beliefs which will certainly affect one's system of values.

As educators, we are interested in behavior. The system might function this way: if, for instance, one values thoughtful management of our energy resources, and if one believes ("knows") that a given elected representative votes for such legislation, then one's action tendency would be to support that person.

So this book is really about behavior. It is not our intent to directly affect anyone's values. It is, most assuredly, our goal to attempt to inform the student, i e., to influence his/her "beliefs" so that they are based on factual data. We also hope that the student's action tendency may be strengthened in favor of responsible behavior in terms of energy questions.

Attitudes do not generally change quickly in and of themselves, but tend to be affected by and affect other attitudes held by the same person. We tend:

1) to perceive things in a way that reinforces attitudes we already have,
2) to notice things that are in harmony with what we already believe, and
3) to be influenced in developing our attitudes by those around us; that is, by those for whom we have a great deal of respect.



A Challenge, A Task . . .

It is our challenge, then, to help young people discover the need to manage energy wisely, to practice energy management principles and to consider the wise use of energy to be important.

Our goal, simply put, is to help our students create a life-style based on a conservation ethic. Conservation is essentially a balance between people and the resources available. You might say that over the past years our desires have outrun nature's bounty. At the same time, our population was increasing and our resources were shrinking rapidly. Americans need to bring this situation back into balance.

The task before us as home economics teachers is three-fold in nature. First, we must have accurate, relevent information so that the student's desire is backed up with know-how. Secondly, we must foster positive attitudes about energy and energy management so that the wise use of energy will become important to *all* our students. And thirdly, we can best support our objectives by setting an example—by being dedicated, efficient and energy-conscious consumers ourselves. We can use the most clever teaching techniques in the world, but unless we "practice what we preach," the fancy techniques may be worthless. The task before us isn't easy. Are you up to the challenge?

How do we go about this challenge of changing attitudes and guiding our young people to a more energy efficient life-style? Carefully!

Ellen H. Richards, the founder of our profession, wrote that "Home Economics stands for the ideal home life for today unhampered by traditions of the past." Perhaps, in view of our country's energy situation, her words are even more appropriate today than they were at the turn of this century when she wrote them!

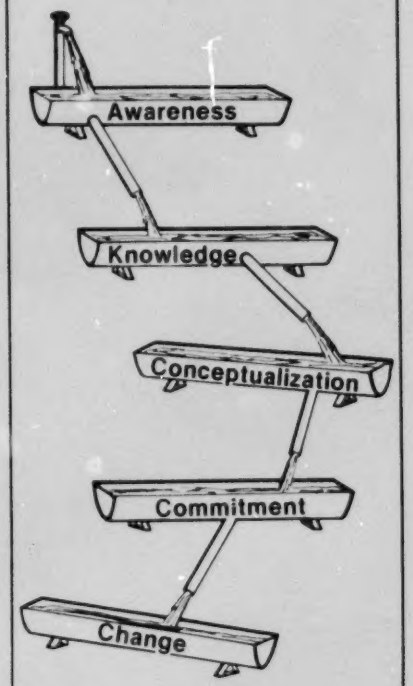
Our quality of life doesn't need to suffer in our pursuit of a less energy-consumptive life-style. There are a lot of things we don't "*need*" to still enjoy "the good life." Nor is it necessary for Americans to make a 'back to nature' swing. We don't want—and in fact it would be impossible—to return to the horse and buggy to replace the automobile. However, we don't *need* heavy automobiles with power windows, reclining seats, fancy wheel covers and back seat speakers. Simplicity can serve our needs and can serve them well.

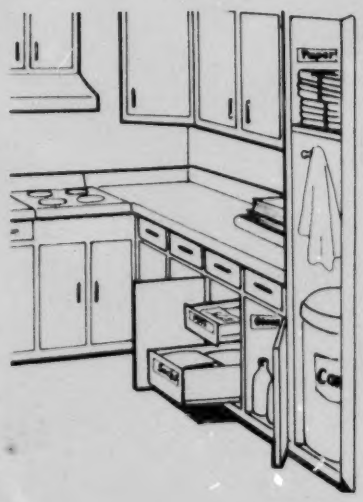
Forward March!

As teachers we are in the uncommon position of being able to influence so many people so much of the time. We work with *students*, who are members of *families*, who live in *communities*! We can and should convince families that their decisions about energy *do* make a difference; *do* have an impact on our country's energy future.

Let's take a look at what it takes to change our minds and our way of doing things to affect attitudes:

First, there must be an **Awareness** of the situation. It is easier to want to make a change if we understand the dimensions of the problem. Second, we need **Knowledge** of the situation in order to interpret the circumstances. Energy information is available to us





everywhere we turn—books, pamphlets, newspaper articles, magazines, television, agencies. Then we need to **Conceptualize** the situation; to develop an image of how we can help by making a change. With that image we can make a **Commitment to Change** our behavior. Once that commitment is made, we can begin to make behavioral **Changes.** Change does not come quickly nor easily. Sometimes it comes through trial and error.

We have done well, as home economists, in some of the beginning steps. We are aware of many situations which need change and we have equipped ourselves with a great deal of knowledge. But in many cases we have failed to help our students conceptualize a response and make a commitment. Change has often escaped our efforts.

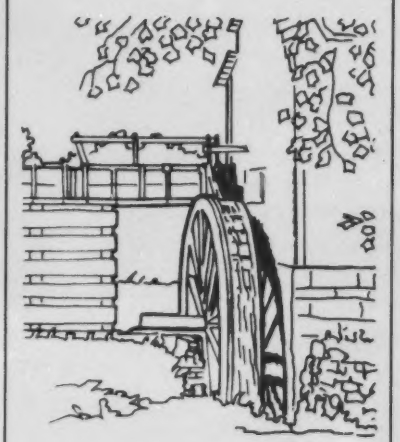
So far most changes in energy conservation have been simply to save money. That's a very good reason to conserve. But there are other, more far-reaching reasons too. When we assume the responsibility for changing our behavior—our energy-using habits—we keep some of the freedom we prize so profoundly. But if we don't assume this responsibility, and leave it instead to legislation, then we have lost some of our freedom of choice. When we conserve energy we are saving some for future generations and buying time for technologists to come up with satisfactory alternatives. Perhaps as educators we have not been embracing our ideas enthusiastically enough. Whatever our shortcomings, we have in our grasp families who can and will become the major agents for change. Let's help them!

Do you want to lead, or should I follow?

As teachers we need to *involve* ourselves with our goal. We cannot preach as we teach. We must commit ourselves, too. Take a look around your classroom. If we're teaching energy efficiency in the kitchen do we have four ovens going with four recipes of baking powder biscuits? Are we recycling—aluminum cans, newspapers, paper sacks, etc.—in the classroom as well as at home? Have we involved other teachers in an interdisciplinary approach to our goal? Consider how interesting it will be for your students to study the fossil fuels in Science, the impact of petroleum prices in Economics, the pros and cons of government intervention into the energy problem in Political Science, the history of America's energy story in History, the impact of the energy shortage on everything around us in Social Studies, and simple energy saving tips in Industrial Arts. We need not be alone in our efforts to encourage our students to become aware, to seek information, to evaluate it, to try change, and to adopt a new behavior. Are you going to catch yourself saying, "Oops, there go my people. I must catch up with them, for I am their leader!"

Part II:
Historical Perspective of Energy

Americans use approximately 1/3 of all the energy generated in the whole world, and yet our country has but 6 percent of the world's population. We have, of course, built a productive country with great technological capabilities which have gained



recognition around the world. We are also the people who circle the block again and again looking for a handier place to park and who select beverages in throw-away containers. To quote Pogo in the comic strip: "We have seen the enemy, and *they* is *us*."

Our country has made a lot of progress since the Pilgrims landed more than 350 years ago. American life now is quite different than it was when the Pilgrims cooked their first Thanksgiving meal. Our accomplishments didn't stop even when our country put men on the moon. We have continued to find new ways to make life easier and more pleasant with "energy saving" conveniences. In so doing we've developed a life-style that will be difficult to change.

Energy—in days gone by . . .

Let's take a look at our energy past. The Pilgrims used wood to build and to heat their cabins, to cook their meals and to provide light. Later colonists used windmills and water wheels to do such things as pump water and grind flour. In the late 1600's a steam pump was developed, and later the steam engine was invented—the first engine to convert heat energy into mechanical energy on a large scale. Increased coal production led to increased iron production. Then came the Industrial Revolution. With that, America became a country dependent on nonrenewable sources of energy. That was more than 200 years ago.

Just a century ago coal and wood were producing equal amounts of energy for Americans. Relatively little energy was obtained from other sources.

At a time when animal oils, widely used for lubricants, were becoming scarce and expensive, a company in Pennsylvania discovered oil in that state. Unfortunately, early American oilmen didn't understand a great deal about the technology or geology involved, and a lot of oil was wasted. Natural gas was known to the early colonists. They found it in swamps and when drilling water and salt wells but considered it a nuisance—a waste product! By the late 1800's some gas reservoirs were tapped to provide local industry with cheap fuel. Natural gas was not used extensively until the 1930's when seamless, pressurized steel pipes were first manufactured, making it possible to transport gas long distances.

Along with new energy sources came new energy technologies. In 1879 the electric light was invented. In 1882 the world's first electric power and generating distribution facility was built in New York. Later strip-mining was introduced as a new method. By World War II our country was making progress in harnessing nuclear energy. Now approximately 92 percent of our energy comes from the fossil fuels—coal, natural gas and petroleum. They are non-renewable. . . when they're gone, they're gone!

Happily Ever After—or so it seemed . . .

As Americans we were living "happily ever after" in our energy-hungry homes, driving energy-inefficient cars and lapping up "energy-saving" appliances until we had to buy bigger and better homes in order to store all our conveniences!

Then came the oil embargo of 1973-74, an event that many of your students, because of their age, will not remember. The mini-crisis didn't *cause* our energy problem today, it merely brought to light what an energy-intensive society we are, and how dependent we are on other countries for our energy. The mini-crisis also made a tremendous impact on prices. Prices of gasoline and motor oil began snowballing and the cost of fuel oil increased. Because many power plants were fueled by oil, electricity increased in price. The demand for coal caused its price to rise. Food prices went up as transportation became more expensive. Manufacturers and farmers were forced to increase prices to maintain their profit margins and we all noticed "over the counter" price increases.

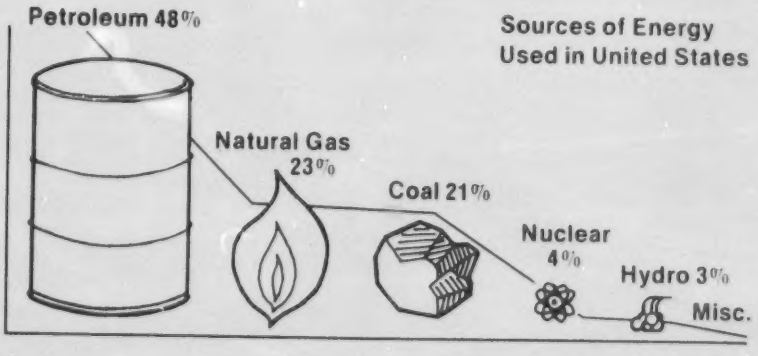
The mini-crisis was felt in other ways too. Frustrations built as motorists waited in lines at service stations. Decreased use of gas meant decreases in other areas and soon restaurants, motels and recreational businesses felt the impact.

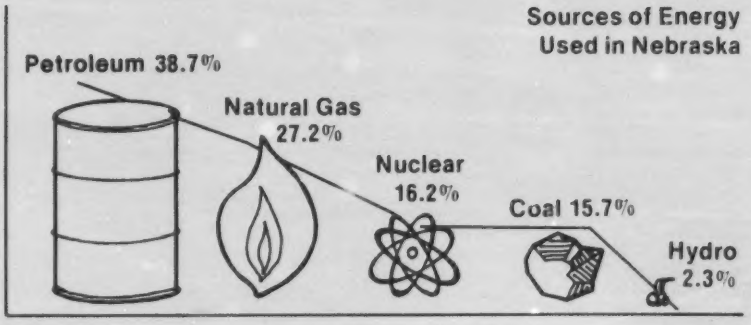
The Prospects . . .

Today almost half of the petroleum we use is imported from other countries, many of them with unstable governments. During the 12-year period from 1970-1982 the United States is expected to use more energy than it did through all of its *entire previous history*! Consider that the world, in the 30-year period from 1970 to the year 2000 will certainly use more energy than it has in the entire history of mankind, about 50,000 years! The National Academy of Sciences suggests that sometime within the next 50-100 years we will run out of oil and gas and that within the next two-to-three hundred years we will run out of coal. Even by decreasing our energy demand through conservation techniques we still have a dilemma. Some of the solution is going to have to come from the people who use energy.

How does Nebraska's "good life" fit into the energy picture?

How do Nebraskans fit into our nation's energy picture? Nebraska's energy usage is depicted by these energy graphs.





An analysis of these figures shows that Nebraska is higher than average, in nuclear power use; slightly higher than the national average in natural gas consumption, but below the national average in petroleum use.

These statistics do not reflect the use of solar energy. Because solar energy has only recently made its appearance on the energy scene it often does not show up in statistics. However, as solar energy use increases it will begin to be reported in statistical studies. From America's early beginnings as colonists to today's triumphs in space our country has made tremendous progress. But in energy technology we've only just begun.

Part III: How Management Fits In

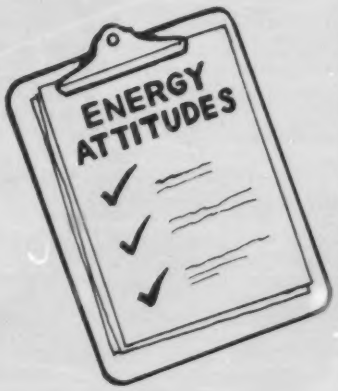
Management is not a general, rigid set of rules and actions, but rather a set of flexible responses to a particular situation. Management is planning the use of resources and then implementing the plans to meet needs. Management is a matter of choices—being able to weigh our options, make decisions and choose the actions which best suit our needs and our resources.

Management is also a matter of good economics—for management is getting the most for our money. Every kilowatt hour (kWh) of electricity we don't use, we won't have to pay for. Every gallon of gasoline we don't burn driving around the block for a better parking place, we don't have to pay for.

Management can have the strongest effect on the "action" part of the attitude. When we *believe* that managing energy is important, and we *value* the concept of being wise energy users, *then we can act by implementing management techniques.*

You probably know people who set out to accomplish something and do it while others, maybe even through repeated efforts, never seem to accomplish their goals. *The way people manage their resources often makes the difference!*

Using what we have—our energy resources and our personal resources—to the best advantage is energy management. Let's begin this study of energy management by taking a broad look at our surroundings, the home and all that it encompasses, and applying our knowledge to it. We'll follow this unit with others on the food we eat and the kitchen we cook it in; the clothing we wear and the textiles we use; and the people, young and old, who occupy this house.



Activities

Intro #1 — Attitude Survey: What do you think?
Intro #2 — Attitude Survey: What do you value?
Intro #3 — Attitude Survey: What do you "need"?
Intro #4 — Energy Quotient

Conduct a survey to determine your students' energy attitudes using the accompanying energy attitude surveys. Unless the students have been exposed to a great deal of information and discussion concerning America's energy situation, they may be undecided about many of their attitudes. Consider giving the survey again at the end of your study of energy management. Keep a tally of the before and after results to see if attitudes have changed. To broaden the base of class discussion ask the students to survey their parents' attitudes. You may also find it interesting to survey fellow teachers and administrators!

To help determine your energy knowledge and that of your students, an "Energy Quotient" test is provided. This makes a good before and after comparison for your energy discussions too. However, before you test students, other teachers, parents, grandparents or others in the community, be sure to test yourself and see if you have a high "EQ."

Intro #1

Attitude Survey
What do you think?

1. Do you think our country has an energy problem?
   _____ yes _____ no _____ not sure
2. Do you think the majority of Americans are **concerned** about America's energy future?
   _____ yes _____ no _____ not sure
3. Do you think you are well-informed about America's energy future?
   _____ yes _____ no _____ not sure
4. Do you think Americans, on the average, have poor energy-using habits?
   _____ yes _____ no _____ not sure
5. Do you think you, as just one person, can have an impact on the overall energy situation?
   _____ yes _____ no _____ not sure
6. Do you think Americans have a responsibility to save energy whenever possible, for the sake of the country?
   _____ yes _____ no _____ not sure
7. Do you feel you are being asked to sacrifice some of the "good life" by being asked to conserve energy?
   _____ yes _____ no _____ not sure
8. Would you be willing to conserve energy in order to save money?
   _____ yes _____ no _____ not sure
9. Do you think that technology is going to "save us" from inconveniences and energy conservation?
   _____ yes _____ no _____ not sure
10. Are you willing to commit yourself to energy conservation?
    _____ yes _____ no _____ not sure

Intro #2

Attitude Survey
What do you value?

Which is most important to you? Give it a "1". Put a "2" by the next most important; the least important gets "3". Do that for each set of responses.

1. ____ a quiet vacation at home with good books, with local trips to museum and swimming pool
   ____ an extensive vacation annually to, say, the ocean or to a large city
   ____ a medium-length vacation taken in the family's air conditioned automobile
2. ____ a picnic on a table on the patio or at a neighbor's
   ____ a picnic at a park several miles away
   ____ a picnic at a local park
3. ____ an elevator ride up one floor
   ____ walking up one floor
   ____ escalator up one floor and walk down
4. ____ a power mower (gasoline motor)
   ____ a riding mower (gasoline motor)
   ____ a push mower (no motor)
5. ____ an electric can opener
   ____ an electric hair blow-dryer
   ____ an electric toaster
6. When the temperature outside is 105 degrees F.
   ____ a home cooled to 72° F.
   ____ a home without air conditioning
   ____ a home cooled to 85° F.

Intro #3

Attitude Survey
What do you "need"?

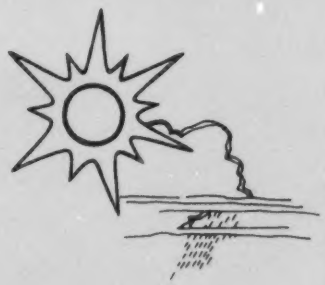
Rank these appliances in order from 1 to 15, 1 being the appliance you think is most important to you. Put the number in the left column. Which **must** you have to live? Make an "A" in the right column. Which do you feel you should be entitled to have? Make a "B" in the right column.

____ ____ dishwasher
____ ____ blow dryer
____ ____ blender or food processor
____ ____ toaster
____ ____ central air conditioning unit
____ ____ microwave oven
____ ____ trash compacter
____ ____ electric frypan
____ ____ electric coffee maker
____ ____ electric iron
____ ____ stereo
____ ____ transistor radio
____ ____ television set
____ ____ curling iron
____ ____ digital clock radio

Intro #4
Energy Quotient

Check your "EQ" by completing the energy awareness test below. Mark the blanks with T for statements which are true and F for statements which are false. Check your answers to determine your "Energy Quotient."

____ 1. A century ago oil was already dominating our energy scene by being the most common source of energy.
____ 2. Natural gas began to see extensive use as a source of energy in the 1930's.
____ 3. Today about half of our energy comes from the fossil fuels.
____ 4. Nebraska utilizes a higher percentage of nuclear energy than the national average.
____ 5. The fossil fuels we use as energy sources are coal, natural gas and petroleum.
____ 6. The oil embargo of 1973-74 caused the energy crunch we are concerned about today.
____ 7. Statistics show that petroleum is the energy source which is used most in Nebraska.
____ 8. Statistics indicate that natural gas is the energy source used most in the U.S.
____ 9. Today nearly half of the petroleum we use is imported from other countries.
____ 10. The three fossil fuels we use most will be depleted in the next century.
____ 11. Nonrenewable is a term used to describe energy sources which, once used, are gone forever.
____ 12. "Petro-products" is a term used to describe products made from the chemicals removed from crude oil during refining.
____ 13. Lipstick, asphalt, artificial turf, polyester and polyvinyl are all examples of "petro-products."
____ 14. Insulation of the attic is the first and most important thing to do in order to "weatherize" a home.
____ 15. The fuel oil used to heat homes is a by-product of natural gas.
____ 16. Coal gasification is a process being developed to turn coal into a gaseous state.
____ 17. The energy derived from the sun's rays is called geothermal energy.
____ 18. The oil embargo of '73-'74 caused so much concern that our country reduced oil imports by 33 percent and has managed to continue reducing oil imports.
____ 19. America has but six percent of the world's population but uses about 1/3 of the energy produced in the world.
____ 20. Another source of oil is found in a fine sedimentary rock called oil shale.



Answers to Energy Quotient

Check your "EQ" answers against the correct answers below. If you have 18-20 answers correct, Congratulations! Your mind is operating "energy efficiently!!" If you have 15-17 answers correct, you're doing well and only a bit more effort will put you in the highest EQ bracket. If you had 12-14 answers correct, you're missing out on a lot of good information. And if you have but 11 answers or less correct, your life is losing miles per gallon; you may need to insulate your mind against so much energy loss!

1. False. A century ago wood and coal were producing equal amounts of energy for our country.
2. True.
3. False. Today more than 90 percent of our energy is supplied by the fossil fuels!!!
4. True.
5. True.
6. False. The embargo didn't *cause* the energy crunch; it just brought to our attention the fact that we were depending on other countries for so much of our energy and that oil is limited in supply.
7. True.
8. False. Petroleum is the most widely used source; petroleum supplies almost half of the energy our country uses.
9. True.
10. False. Although the oil and natural gas will be depleted in the next century, the National Academy of Sciences predicts that coal will last another two-to-three hundred years. Some estimates give even longer duration—given that we will accept higher pollution levels, higher costs and destruction of much of our landscape.
11. True.
12. True.
13. True.
14. False. Experts tend to recommend checking the thermostats (lowering the settings in winter and raising the settings in summer) and installing weatherstripping and caulking as the first energy conservation steps. Once these steps have been taken insulation should be considered.
15. False. Fuel oil is a by-product of crude oil.
16. True.
17. False. Energy from the sun is called solar energy. Geothermal energy is that derived from within the earth's crust, as in volcanoes, geysers, etc.
18. False. Instead of decreasing imports America continued to *increase* its imports of oil following the embargo.
19. True.
20. True.

2 Housing And Home Furnishings

Introduction

'Mid pleasures and palaces though we may roam,
Be it ever so humble, there's no place like home;
A charm from the skies seems to hallow us there,
Which sought through the world is ne'er met with elsewhere.'

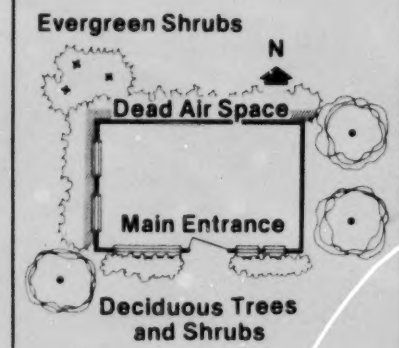
John Howard Payne

The references to home in song, poem and story are numerous. And anyone who has ever experienced homesickness knows the thoughts and emotions which are summoned when we think of home: playing checkers as a child on a stormy winter evening; making home-cranked ice cream in celebration of a favorite holiday or birthday observance; or a faded-with-time photo of an ancestor in an old, gilded frame. Many a sod house on the Nebraska prairie, simplistic in design and furnishings, sported a framed piece of needlework which pronounced "Home Sweet Home".

The objective of this unit is to incorporate energy management into the course of study in Housing and Home Furnishings. It is not a "how to weatherize your home" manual. It is assumed that the person concerned about energy use has already taken energy-saving steps such as insulation, caulking and weatherstripping. This Guide goes one step beyond weatherization—to getting the most from your energy dollar by managing the energy you have.

We'll take a look at how energy management fits into the home by examining:

1. Site Orientation and Landscaping for Energy Efficiency
2. The Energy Efficient Mobile Home
3. The Energy Efficient Apartment
4. Humidity and Temperature Control
5. Lighting
6. Draperies and Window Treatments
7. Psychology of Room Arrangement, Color and Texture
8. Efficiency Through Hot Water Use
9. Efficiency Through Portable Appliances
10. Alternate Housing



Lesson 1 — Site Orientation and Landscaping for Energy Efficiency

Objectives: Upon completion of this lesson students will be able to describe the factors which are important to the site orientation and landscaping of a dwelling in relationship to energy conservation.

Background Information: Attached.

Activities: Attached

HHF #1 — Determining the Site Orientation of your Home (Jr, Sr, Adult)

HHF #2 — Landscaping for Energy Efficiency (Jr, Sr, Adult)

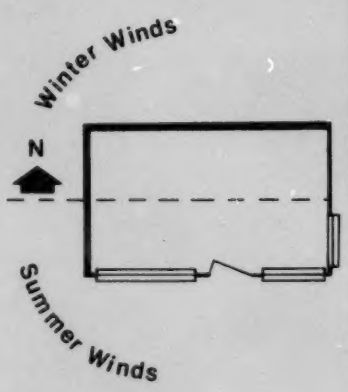
HHF #3 — Window Area Survey (Sr, Adult)

Resources: U.S. Department of Agriculture Fact Sheet 2-3-15, "Energy Conservation in the Rural Home: Locating New Home Sites To Save Fuel" and Agriculture Fact Sheet 2-3-5, "Energy Conservation in the Rural Home: Landscaping To Cut Fuel Costs."

"Save Energy—Save Dollars," New York State College of Human Ecology and New York State College of Agriculture and Life Sciences, Cornell University, 1977.

Suggestions: Invite a landscape architect or nursery representative to attend class and discuss the contributions of trees and shrubs to energy management.

Visuals: Using the visual (Fig. #1) from the resource section, evaluate the siting, placement of coniferous and deciduous trees and shrubs and the placement of doors and windows. Draw in a floor plan for this two — bedroom home.



Lesson 1 — Site Orientation and Landscaping for Energy Efficiency

The home is a source of comfort to us. Comforts require energy, and energy costs money. In the United States about 19 per cent of the energy consumed is used in homes, and a large portion of that energy is used for heating and cooling.

The average home in Nebraska uses 22½ barrels of oil a year. To determine how this energy is used, the Nebraska Energy Office compiled statistics for the city of Lincoln for the year 1976. Energy-use within the home broke down this way:

Space Heating	47.2%
Water Heating	13.2%
Space Cooling	10.7%
Refrigerator	6.3%
Freezer	5.4%
Lighting	4.8%
Range	3.7%
Dryer	3.2%
All Other	5.5%

It is easy to see that as home dwellers—a home meaning a house, apartment, condominium, trailer—we have direct control over a great deal of the energy consumed in this country. We can greatly influence the energy use by the type of house we choose to live in, how we landscape it, how we furnish it, how we light it and the types of appliances we buy to put in it.

One of the best places to begin our study is with the placement of the house. Consider its relationship to the terrain, the wind and sun, and the way it is landscaped.

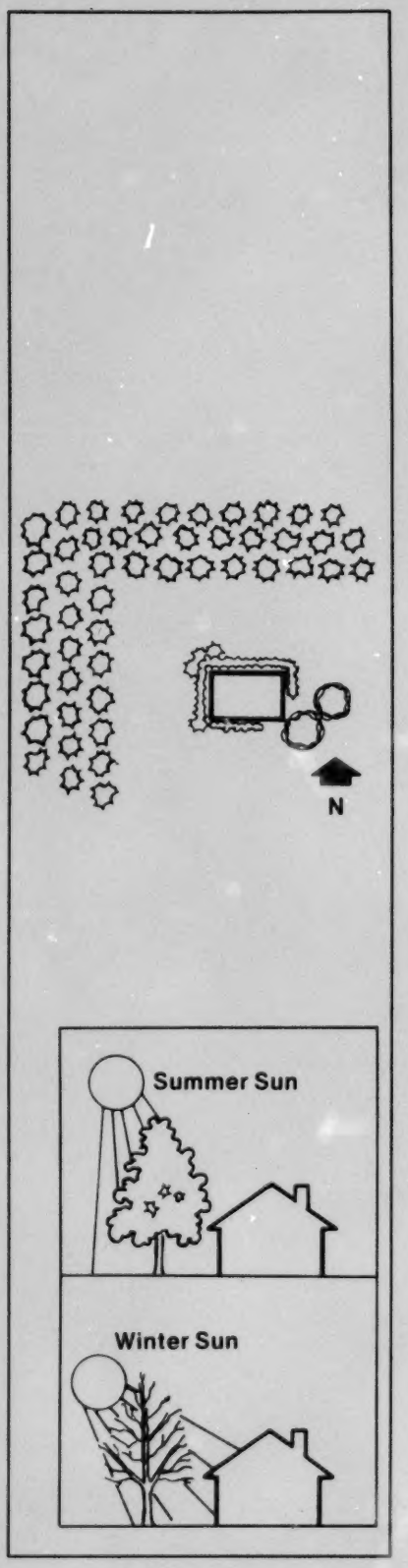
These principles can be applied to planning a site and landscaping for a new home or improving an existing house.

The Site

Keep the sun and wind in mind when positioning the house and be sure to check zoning regulations. A rural house can be more easily oriented to take advantage of natural elements. Locating the main roof of the house parallel to the east/west axis allows more south-facing windows and more passive solar heat gain. It also can provide a desirable location for a solar collector.

Winter winds generally come from the northwest (summer winds from the southwest), so walls on that side of the house should have the best insulation and the least number of openings. When possible, the shortest wall should face northwest.

The largest window areas should face south/southeast so that the low winter sun will shine into them during the day hours and they will be shaded by the overhang in summer. Windows are the single largest source of heat loss from a structure, even with storm windows or double glazing. The window area of a home usually is equal to about 15 per cent of the floor area. This can easily be reduced to 10 per cent. This is best done by raising the window sill height. Highest windows provide better natural light, while reducing heat gain in summer because the upper portion of window can be shaded by the overhang.



Living activity areas, with larger windows, are best located to receive daytime sun. Sleeping areas should be located where less sun reaches them. In cold winter climates, such as Nebraska, locate attached garages on the north, northeast or northwest sides of the house.

The shape of the house also makes a difference in the cooling and heating costs. A round house is the most energy efficient shape, but not everyone wants to live in a round house! A square or rectangular house is the next most practical. Dwellings with an L, H, U or T shape will use more energy because more wall area is exposed to the elements.

Even roofs should be designed with climate in mind. The color of the roof influences in heat gain. Light colored roofing materials reflect rather than absorb sunlight and are more efficient in warm climates; a dark-colored roof would be better in cold areas.

Landscaping

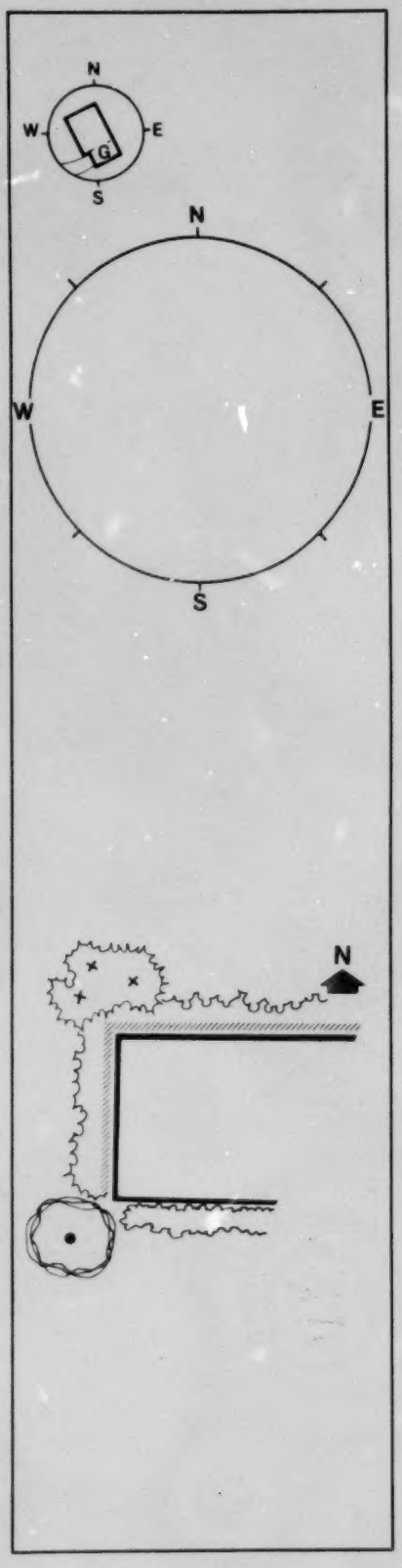
Planting trees and shrubs will also help to reduce heating and cooling costs. Well placed shrubs and trees cut heat loss in winter by obstructing the wind. Windbreaks and shrubs around the foundation reduce on the amount of cold air which penetrates through cracks around the windows, doors and pores in the walls. Studies show that windbreaks can reduce winter fuel consumption by 10-30 percent. According to the United States Department of Agriculture, one study in Nebraska compared the fuel requirements of identical test houses which maintained a constant inside temperature of 70°F. The house protected by a windbreak used 23 percent less fuel.

A tree's height and density of trees determines the amount of protection they will provide. Windbreaks of two to five rows of trees generally provide good protection. Evergreen trees (coniferous trees) provide the best protection, although low, branching deciduous trees (trees which shed their leaves) can greatly reduce wind speed.

Trees and shrubs planted close to buildings create a "dead air" space which slows the escape of heat from a building. Evergreens and shrubs should be planted close together to form a tight barrier against air movement. In the summer this dead air space also helps insulate the house from hot outside air, thus reducing the need for air conditioning.

Just as trees and shrubs offer protection from winter winds they also shade people and buildings from the direct rays of the sun. During winter deciduous trees and shrubs shed their leaves and let the sun's rays help warm the house. This is an important consideration when planning for summer shade on the southern and western exposures of your house.

Maples and other trees with full crowns are best for summer shading. Their high branches permit greater visibility and do not block the flow of cooling summer breezes.



HHF#1
Determining the Site Orientation of Your Home

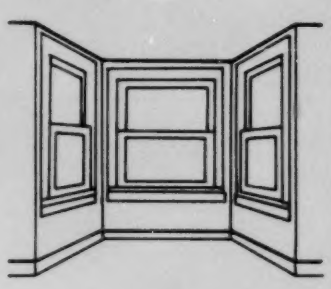
1. Using the circle provided, draw (using a bird's eye view) your home (house, apartment building, mobile home, etc.) in the center facing the proper direction.
2. Indicate the direction of the prevailing winter winds with an arrow.
3. Indicate the direction of the prevailing summer winds with an arrow.

The direction of prevailing winds can be obtained from the nearest U.S. Weather Station, your county extension agent or Soil Conservation Service. A sample house is given for you. The garage is indicated by the letter "G."

4. Do you think your home has good orientation to the sun and wind?
   Explain your reasons.

HHF#2
Landscaping for Energy Efficiency

1. In the space below draw your home from a bird's eye view in proper perspective to North.
2. Draw the trees and shrubs around your home, labeling the evergreens, deciduous (shed leaves in the fall) trees, evergreen shrubs and deciduous shrubs.
   A portion of a sample house is given.
3. Do you think your home is well protected from the wind?
4. Is your home oriented to utilize the sun in winter and be protected from the sun in summer?
5. What, if anything, could be done to improve the landscaping around your home? Explain or indicate in another color.



HHF#3
Window Area Survey

Because windows are the largest source of heat loss from a structure, it can be helpful to determine the total window area in your classroom, your bedroom or your home. The average window area is 10-15 per cent of the total square footage of the floor area. Remember to measure only the **glass** portion of the windows. This same procedure can be used to evaluate the window area in blueprints for a new structure.

Your formulas:

1. to determine square footage: length (in feet) X width (in feet) (or if you measure windows in inches:

$$\frac{\text{length X width (in inches)}}{144} = \text{square footage}$$

2. to determine percentage of glassed (window) area:

$$\frac{\text{window area (in square feet)}}{\text{floor area (in square feet)}} = \text{percent of glassed area}$$

Example: a room is 12 feet wide and 14 feet long, and has 3 windows, each measuring 2 feet by 3 feet.

12 X 14 = 168 sq. ft.

2 X 3 = 6 X 3 = 18 sq. ft. of glassed area

$$\frac{18 \text{ sq. ft.}}{168 \text{ sq. ft.}} = .107 = 10.7 \text{ per cent glassed (window) area}$$

1. Your classroom has _____per cent of glassed (window) area.
2. Your room at home has _____per cent of glassed (window) area.
3. Your home has _____per cent of glassed (window) area. To do this you must first determine the square footage of your whole house and the total square footage of all glassed areas.

Lesson 2 — The Energy Efficient Mobile Home

Objectives: Upon completion of this lesson students will be able to list factors which should be considered in selecting and siting a mobile home for maximum energy efficiency.

Background Information: Attached.

Activities: Attached

HHF #4 — Siting and Landscaping a Mobile Home (Jr, Sr, Adult)

Resources: U.S. Department of Agriculture Fact Sheet 2-3-6, "Energy Conservation in the Rural Home: Weatherize Your Mobile Home To Keep Costs Down, Comfort Up."

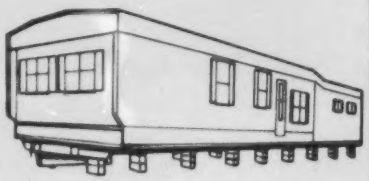
"Save Energy—Save Dollars," New York State College of Human Ecology and New York State College of Agriculture and Life Sciences, Cornell University, 1977.

"Residential Energy Consumption: Baseline Comparison of Single Family Detached Homes," Gas Research Institute, Chicago, Illinois, 1979.

Suggestions: Visit a mobile home dealership or manufacturer (there are several in Nebraska) and take a tour of a new mobile home, checking its energy-efficiency qualities.

Visit a mobile home which has been sited and landscaped and evaluate the energy conservation measures.

Visuals: Using the visual in the resource section (Fig. #2) evaluate the siting, landscaping, orientation of windows and doors of the mobile home. Discuss the advantages and disadvantages of each.



Lesson 2— The Energy Efficient Mobile Home

Energy efficiency should rank high on your list of priorities when you consider a home—whether you buy or rent, a single family dwelling, condominium or mobile home. With a little planning and effort the mobile home can be as comfortable and as energy efficient as possible.

Mobile homes are unique because they are the most complete factory-built home. The completed mobile home is moved to its site and set on concrete blocks. The mobile home doesn't have a foundation or a basement. Because it must be transported to its site, the mobile home must adhere to shipping regulations. Width regulations severely limit room arrangements, so the floor plan is the least flexible of all home types. (Nebraska regulations read a maximum width of 16 feet.)

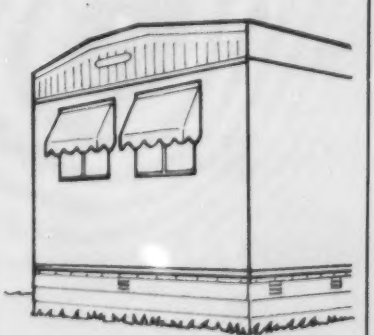
Several structural aspects of the mobile home— detachment from the ground, metal exteriors, relatively thin walls, ceilings and floors, and elongated, compartmentalized interiors—must be considered. The compartmentalized interiors restrict the flow of air making heat and cooling difficult. However, mobile homes have been carefully designed to make the maximum use of the floor space.

Mobile homes built after July 15, 1976 must comply with the Mobile Home Construction and Safety Standards issued by the U.S. Department of Housing and Urban Development (HUD). It must meet basic requirements for condensation control, air infiltration, and thermal insulation in the ceiling, walls and floors. A label attached on an interior wall of the home indicates it meets these standards.

Mobile homes have which meet higher standards for thermal protection are labeled as "Energy Conserving Homes." These homes have received a HUD heating and cooling certificate. If the mobile home bears neither of these indications, then it will probably be up to the owner to weatherize it.

Just as in planning or selecting any single family home, site orientation and landscaping are extremely important for energy efficiency. The United States Department of Agriculture lists several considerations in siting the mobile home:

1. In extreme climates, such as in Nebraska, locate the long sides of the home to face north and south to take advantage of the winter sun.
2. Windbreaks are needed most along north and west sides. Consider:
   - — semi-enclosed carport
   - —larger evergreen shrubs
   - —evergreen trees that hold their lower limbs
   - —a tall fence
3. Shade the south side in summer with
   - —awnings
   - —porches
4. Plant deciduous trees on the east, west and south sides of the home.



Heat is lost from mobile homes through ceilings, floors, windows and walls. Installation of skirting is one of the most effective energy conservation measures. The skirting helps cut drafts,

helps to insulate, and keeps high winds from producing an uplift effect on the house. A permanent, non-combustible material is recommended for skirting. This can be corrugated metal or plastic as well as concrete blocks or brick. However, as with all insulation and weatherstripping, do not seal vents which provide for air circulation and ventilation for the home's heating system.

Experts also recommend installing fiberglass batts beneath the floor or insulating the skirting. Weatherstripping and caulking around windows, doors, joints, nails, screws, roof vents, wheel housing, moldings, etc., are also essential to weatherize a mobile home.

Most of the heat loss in a mobile home is through the ceilings and roof. A urethane foam material can be sprayed on the roof, preferably 2-3'' thick, and then topcoated with a protective liquid glass sealer to prevent discoloration and deterioration.

Energy savings can be increased by insulating the windows. A 4 to 6 mil layer of plastic sheeting can be taped to the inside or outside of the window. Also effective are ''insiders''—clear plexiglass attached to the inside of the window to block air flow.

Exposed water pipes should be wrapped with pipe insulation that is fitted and taped carefully over the full length of the exposed area.

Recommended thermostat settings are:

—Heating season: — 65-68 degrees F. Lower the setting another 5-10 degrees at night.

—Cooling season: — 10 degrees F. below outside temperature but not lower than 78 degrees F.

Weatherization principles are the same for modular homes. These are homes which are assembled in half-sections in factories, shipped to the site and set on permanent foundations. Two half-sections constitute one home. Modular home floor plans are also somewhat limited because of shipping regulations.

Mobile homes provide comfortable, economical housing. Conscientious weatherization efforts can pay off.

HHF#4

Siting and Landscaping a Mobile Home

Pretend that you have just purchased a new mobile home. In the space below, and taking into consideration the directional arrow, place your new home on its site and landscape it for the best use of energy. Label the trees and shrubs and any other features you might add to get the most from your energy dollar. Be sure to label which trees are deciduous (trees which lose leaves in the fall). Indicate the garage and drive-way. Draw a box to show where you would place a window air conditioner. Label it AC. What other things might be used to cut heating and cooling costs?

Lesson 3 — The Energy Efficient Apartment

Objectives: Upon completion of this lesson students will be able to list some criteria for evaluating the energy efficiency of an apartment.

Background Information: Attached.

Activities: Attached

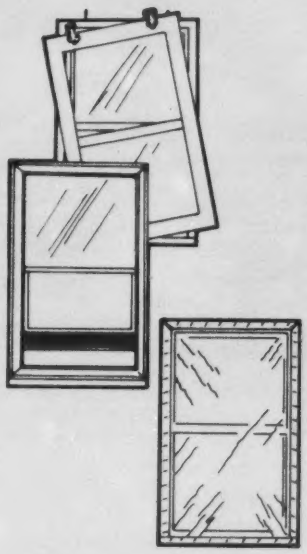
HHF #5 — Apartment Energy Efficiency Checklist (Sr, Adult)
HHF #6 — Apartment Case Study (Sr, Adult)

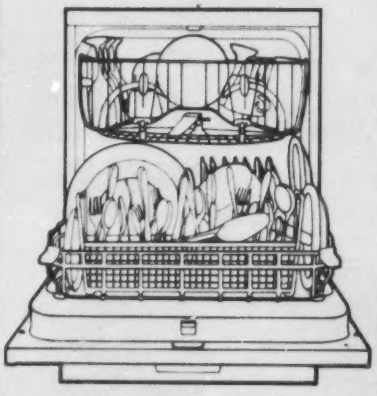
Resources: "Save Energy—Save Dollars," New York State College of Human Ecology and New York State College of Agriculture and Life Sciences, Cornell University, 1977.

"Put Your House to Work Saving Money for You," Exxon Corporation, 1979.

Suggestions: The Apartment Energy Efficiency Checklist (Activity Sheet HHF#5) can be done as a class or individually. With the completed check list, visit an apartment or apartment building and evaluate them according to the guidelines you've set on the Checklist. Now, back in class, review your Checklist to see if it was adequate. What other items might be added?

Visuals: Locate the visual (Fig. #3) in the resource section which can be used with Activity Sheet #6 — Apartment Case Study.





Lesson 3 — The Energy Efficient Apartment

Energy efficiency should be given just as much consideration in selecting an apartment to rent as in choosing a house to buy. The biggest difference in the energy efficiency criteria maybe in the fact that as a renter you do not have access to as much information as you'd like, and you have less control over what changes can be made.

Take a good look at an apartment for its energy-using advantages and disadvantages. Are there storm windows? Are some areas of the building heated unnecessarily, such as basement storage areas or hallways? Are apartments metered separately? Does the renter or the building owner pay utility bills? Are the building and the apartment in a good state of repair? What is the temperature of the hot water? Is the building well insulated? Check the age of the air conditioning and furnace units. When were they last given a maintenance check by a qualified serviceperson?

The desirable apartment owner is an energy management advocate. By asking some of the above questions you may be able to discover the person's attitude about energy management as well as the energy efficiency of the apartment.

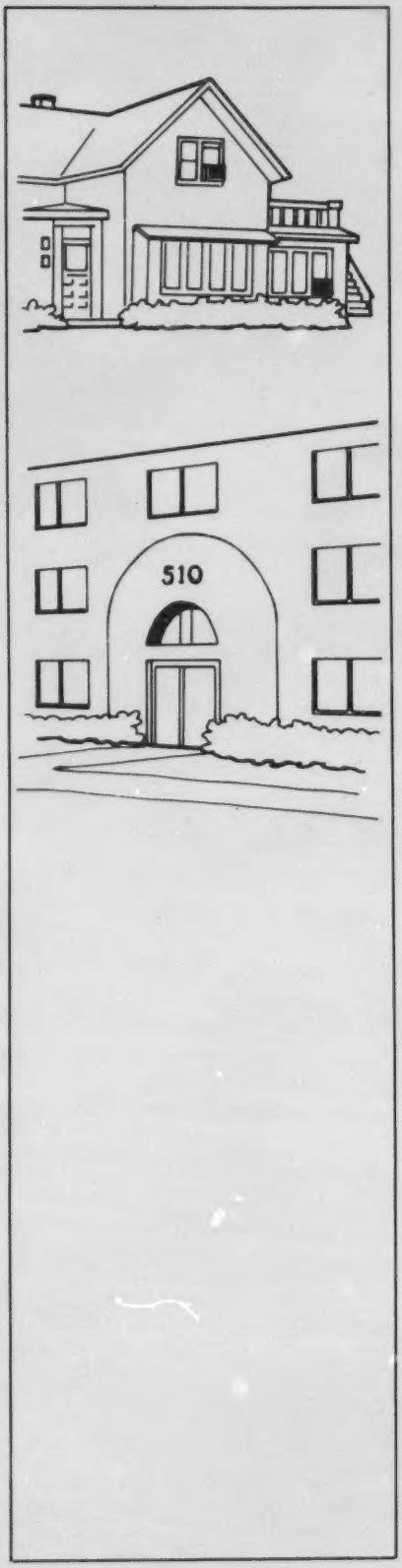
The energy efficient apartment has storm windows. Check the windows, doors and foundation for weatherstripping and caulking. If the owner doesn't do those things they may provide the materials on a do-it-yourself basis. When storm windows are absent the installation of 4-6 mil plastic sheeting either inside or outside the window is an effective substitute.

Check the utility bills for the apartment. They may be available from the utility companies. If basements or hallways are heated valuable heat is being lost and the rent is helping to pay for that lost heat. Separately metered apartments are an incentive to the apartment dweller to conserve energy. When a consumer can see, in kilowatt hours or cubic feet, how much energy he/she is using (and is therefore paying for), there is a greater incentive to conserve. When utilities are included in the rent, you may find that your rent money also pays for other renters' wastefulness.

Who pays for the hot water? Does hot water come from separate units or one large unit for all apartments? Whether the water heater is in your apartment, or located in the basement and its costs are included in your rent, the need to conserve hot water remains important. Heating water for home use is second only to heating and cooling in the amount of energy required in a home.

Showers usually take less hot water than baths. Using the dishwasher only for full loads, and using cold or warm water washes with cold rinses in the washing machine will cut down on hot water consumption. Timers can be purchased for room air conditioners which turn on the unit 30-60 minutes before the occupant comes home.

Check around the window air conditioning unit for air leaks. This can be a major source of air infiltration. Intake vents on the air conditioner should be closed during the cold months. The air conditioning unit should be covered and sealed on the outside during winter.



It is important to remember that the location of the apartment within the building itself can make a considerable difference in the energy expenditure. In general, apartments with common walls will have lower utility costs. And usually a downstairs apartment will be warmer.

The location of the entry door is also important. Does the apartment open directly to the outside or is there a vestibule or other than direct outside opening? The rush of cold air from the outside directly into the apartment will quickly drop the inside temperature.

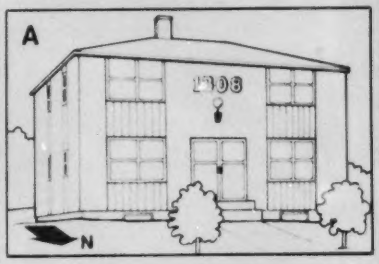
There are also many steps which the apartment renter—like the homeowner—can take to make an apartment more energy efficient. Weatherstripping and caulking are cost-effective weatherization techniques. Window treatments, such as an inexpensive shade which fits closely to the window frame, will reduce heat loss. Carpeting is a good insulator and "feels" warmer.

You should also consider the proximity of the apartment to work or other activities. Being alert in the selection of an apartment can prevent many energy "headaches" later on.

HHF#5
Apartment Energy Efficiency Checklist

Using the information you have read and discussed in class, prepare a checklist for evaluating an apartment for energy efficiency. A sample checklist is started for you, or you may design your own. Include all the items you would check in the apartment.

	Good	Fair	Poor
1. Storm windows			
2. Separate meters			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			



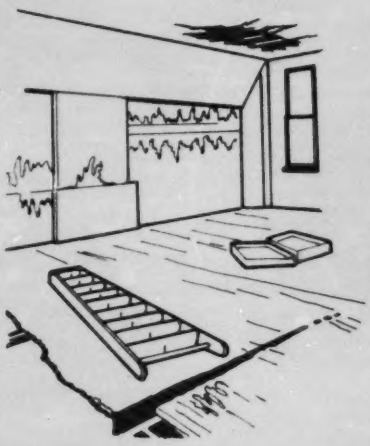
HHF#6
(Visual Fig. #3)
Apartment Case Study

From the information provided, evaluate the two apartments described in the case study below. You may be able to use your Apartment Energy Checklist to help you compare the disadvantages and advantages of the two apartments. The two units are of comparable size and comparable rent.

Case A — First floor apartment in 4-apartment building (another apartment above, another beside). Heated basement. Double entry door. Storm windows. Some weatherstripping. No caulking. Large picture window and door to building face north. Apartment has steam heat provided by fuel oil. Apartment building has central air conditioning. All utilities are included in the rent. Faces street. Building is four years old. Two young pin oaks have been planted near the sidewalk, otherwise little landscaping.

Case B — Apartment is entire first floor of house. Another apartment above. Basement is unheated. Single entry door faces south. Room air conditioner is in the south window. Large weeping willow tree shades south side of house in summer. House is 30 years old; insulation is commensurate with the age. Landlord has caulked and weatherstripped. Storm windows are provided. Apartment has hardwood floors throughout except the kitchen and bath. Kitchen and bathroom have linoleum floors. Windows are furnished with sheer curtains. Renters pay own utilities. Heat is provided by natural gas; separate meters exist for each apartment.

1. Based on your evaluation, which apartment is probably more energy efficient? Why?
2. What could be done to make apartment A more energy efficient?
3. What could be done to make apartment B more energy efficient?
4. If you rented apartment A what energy-saving steps would you pursue first? Why?
5. If you rented apartment B what energy-saving steps would you pursue first? Why?



Lesson 4 — Humidity and Temperature Control

Objectives: Upon completion of this lesson students will be able to explain the affect humidity can have on the comfort and health of family members, and how thermostat settings can affect the heating and cooling bills.

Background Information: Attached.

Activities: Attached

HHF #7 — Humidity and Temperature Control — Discussion Questions (Jr, Sr, Adult)

Resources: "Tips for Energy Savers," Federal Energy Administration (presently U.S. Department of Energy), 1977.

"Humidity and the Indoor Environment," information fact sheet, Minnegasco Consumer Services.

"Nebraska Energy Saving Manual," Nebraska Energy Office, 1979.

Suggestions: Show examples of several types of insulation. Include insulation with attached vapor barrier and another type such as beadboard insulation (expanded polystyrene), which allows vapor to permeate through it.

If possible, show pictures of attics or crawl spaces where water damage has occurred due to poor ventilation systems.

Lesson 4 — Humidity and Temperature Control

As Nebraskans we all know how uncomfortable we feel on a hot, "sticky" summer day, and we've probably all experienced the dry skin or static "shocks" in the wintertime when the air is very dry. However, not many of us have stopped to think much about how moisture in the air, or the lack of it, affects more than just our comfort. It has a large bearing on our health and energy bill, too.

The moisture in the air is called humidity and is measured as "relative humidity." **Relative humidity** is the percentage of moisture in the air in relation to the amount of moisture the air could hold at any given temperature. (For instance, if the relative humidity is 45 per cent, the air could hold 55 per cent more moisture before it becomes saturated.)

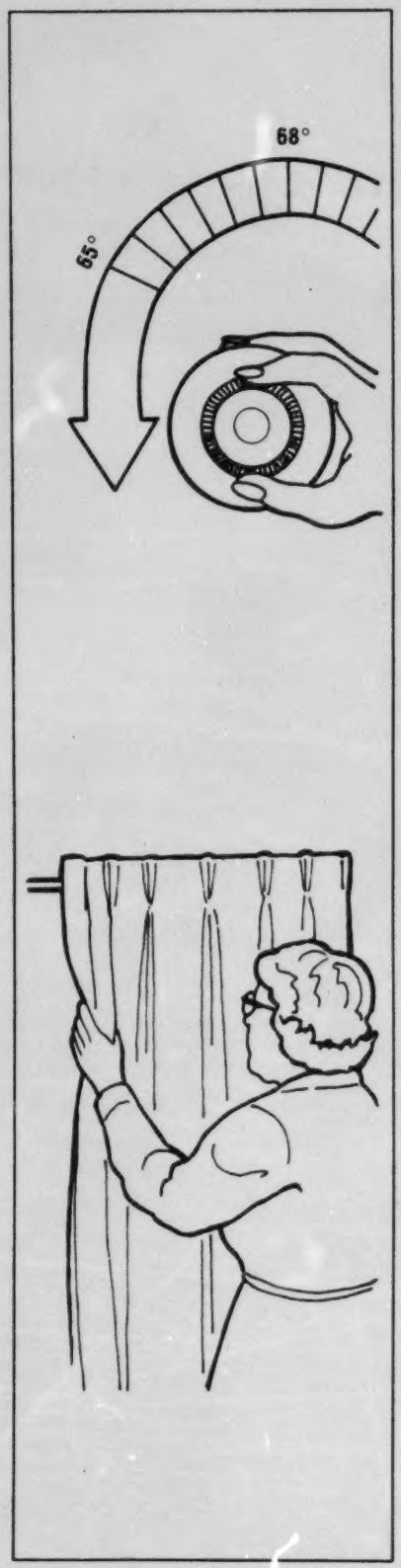
We feel uncomfortable if the relative humidity is too high—the skin feels "clammy." If the relative humidity is too low, the skin becomes dry, and so do the mucous membranes in the nose and throat. The human body is most comfortable when the range of humidity stays in the 20-60 per cent range, although relative humidity at 30-50 per cent is considered the ideal. In a house, water vapor permeates floors, walls and ceilings. Most homes "breathe" so that moisture can escape. Ventilation is necessary to prevent moisture damage in areas such as walls, attics or crawl spaces.

Excess humidity can be damaging, especially in winter, when condensation (moisture changing from a gas to a liquid) occurs. When warm, moist air contacts a cool surface, such as a window or outside wall, condensation occurs producing drops of water which may freeze if the outside temperature is cold enough.

If the windows in a home fog up heavily then perhaps too much humidity is present. It may be necessary to take steps to reduce the amount of moisture in the home, or open the window a bit to allow some moisture to escape. Some experts say that in winter if condensation is just barely forming in the corners of windows, then an acceptable amount of moisture is present. This also shows that the interior window is tight and that warm air is not escaping to the outside. It is also imperative that "weep holes" pencil-sized openings in the lower front of the frame to allow for ventilation of air and moisture are open on an exterior window to allow a transfer of moisture.

The colder the air the less moisture it can hold. As air is warmed, its ability to hold moisture increases. Additional heating, as in the winter, tends to dry air out. Low humidity causes the body to lose valuable moisture through evaporation which produces a chilled feeling. Proper humidity levels in the home would allow you to keep the thermostat setting a degree or two lower.

Humidity for winter comfort can be achieved in a number of ways. A humidifier can be installed on a hot air furnace. There are portable humidifiers which can be moved from room to room. A typical family of four produces about 18 gallons of moisture per week by bathing, cooking, and other activities in the home. Moisture is also added naturally by breathing and house plants. Moisture can be added in winter by venting a clothes dryer to the



inside. Then, as the days begin to warm up it is important to vent the dryer outside.

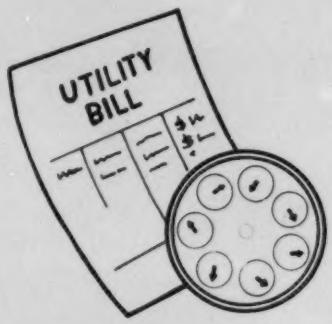
As much as 3/4 of the energy expended in the home is used for heating and cooling, so using the furnace and air conditioner wisely will have quite an impact on the energy budget. Indoor wintertime temperatures of 65-68°F. during the day and 55°F. at night have been recommended for energy conservation. Americans became accustomed, in the days of cheap energy, to dressing only for style instead of comfort. Now with the vital need to conserve energy, we can dress for comfort but still be stylish.

According to the U.S. Department of Energy, **you can save about three percent of your fuel costs for every degree you reduce the temperature in your home. You can also save about one percent for every degree you dial down only at night.** It makes sense to lower the thermostat setting and don a sweater for comfort.

Besides thermostat settings, you can influence fuel costs by practicing other simple energy habits. Close off rooms which are not in use. Limit the use of kitchen and bath ventilation fans to about 10 minutes at a time. Although essential for humidity control, these fans also blow away warmed (and cooled) air while blowing away odors. Keep fireplace dampers closed unless a fire is going. Keep windows near the thermostat tightly closed—or the furnace will be overworked. To operate efficiently, appliances must be cleaned and maintained regularly. Change furnace filters every month for maximum efficiency. Check heating ducts for air leaks, and repair leaks which are found. During winter keep draperies and shades open in sunny windows; close them at night.

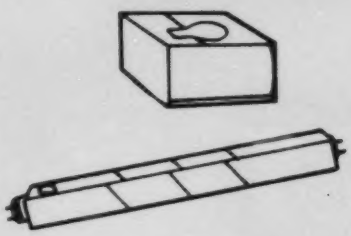
Overcooling in summer is expensive and wasteful. Set the thermostat at 78°F. or higher in summer for a reasonably comfortable temperature. The higher the setting, the less difference there is between indoor and outdoor temperatures. Consequently, less hot outdoor air will flow into the house. Keep out the daytime sun by drawing draperies, installing shades or awnings. This is a very effective way to reduce heat gain from the sun's rays. Also dress for comfort. In summer's heat, when the humidity is very high, consider leaving the air conditioner on all night instead of opening up the windows. About 1/3 of the energy used by an air conditioner is used to remove moisture from the air.

Using good common sense to control humidity, heating and cooling practices means good energy management.



HHF#7
Humidity and Temperature Control

1. What are some ways humidity can be added to the air without the use of humidifiers or vaporizers?
2. What are the advantages of a clock thermostat for a heating system?
3. What advantages would a whole house ventilation system or a ventilating fan installed in the attic or an upstairs window have in summer?
4. What is meant by peak load? What can be done to take the strain off power companies during peak load hours in summer? What does a power company do to allow for peak loads?
5. What are the rates for electricity in your area? Do summer and winter rates differ? What kinds of rate scale does the power company have? Who pays the lowest rates? Who pays the highest rates?



Lesson 5 — Lighting

Objectives: Upon completion of this lesson students will be able to list the factors which determine efficient lighting techniques, and describe the three types of lighting available for home use.

Background Information: Attached.

Activities: Attached

HHF #8 — Determining Task Lighting Needs (Jr, Sr, Adult)
HHF #9 — Light Bulb Efficiency (Jr, Sr, Adult)
HHF #10 — Lighting Cost Comparison (Sr, Adult)
HHF #11 — Lighting Word Scramble (Jr)

Resources: An Energy Education/Conservation Curriculum Guide for Home Economics Teachers, University of Tennessee, 1977.

"Tips for Energy Savers," FEA, presently DOE, 1977; "Lighting" Fact Sheet, U.S. Department of Energy, 1978.

"New Energy-Saving Lighting Products Developed by General Electric," Press Release by General Electric, 1980.

"Homeowner's Guide to Energy Efficient Lighting," by Mel Famey, Home Energy Digest, 1980.

"Energy-Saving Lighting," Popular Science, September 1980.

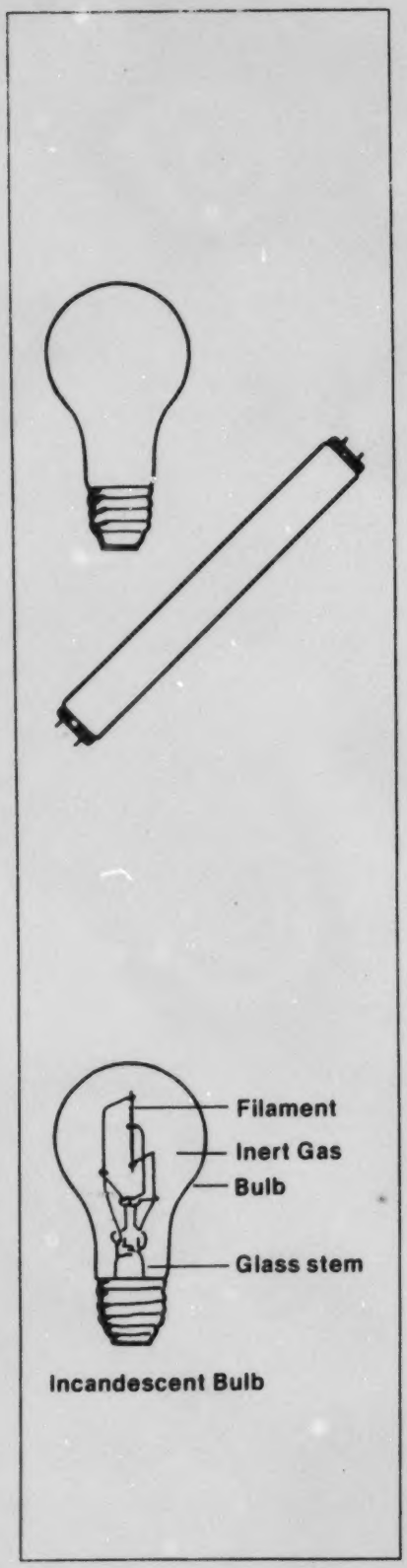
Suggestions: Borrow samples of new lighting products, such as the Circlite, electronic Halarc, 4 watt nightlight, etc. from lighting stores to show the class.

Ask school maintenance personnel for empty fluorescent and incandescent bulb boxes to use as examples.

Visit a lighting store or the lighting section of a hardware store to see examples of various lights.

Many public utility companies and the Cooperative Extension Service have resources and programs available on lighting.

Visuals: Fig. #4 — Fluorescent Lamp Selection Guide
Fig. #5 — Efficiency of Various Light Sources



Incandescent Bulb

Lesson 5 — Lighting

Twenty percent of all the electricity generated in the United States today is used for lighting homes and businesses, according to the U.S. Department of Energy. And yet reducing that energy expenditure is sometimes as simple as flipping a switch. Conserving energy in lighting essentially means using lighting only when needed, and selecting the right light for the job.

A variety of light sources is available, from small, dim night lights to high powered lights illuminating a stadium for an evening sports event. Just as an automobile has a "miles per gallon" energy efficiency rating, so does a lamp. Lighting sources are rated in "lumens per watt." The measure of how much light is produced is called a **lumen.** The amount of energy used is measured in **watts**. For example, a 40-watt fluorescent tube that delivers 66 lumens per watt is more than five times as efficient as a 40-watt incandescent bulb that delivers only 12 lumens per watt. This means that the difference in the amount of lumens obtained from each watt has an impact on the amount of electricity required to light a room or home. The efficiency of light sources varies from less than 10 lumens per watt to more than 130 per watt. Wattage and lumens are listed on the bulb or tube packaging.

The brightness of light is measured in **candle power**. One candle power is the brightness of light given off by one standard candle. The intensity of light at any point one foot from a standard candle is called a **footcandle**. The intensity of light decreases with the distance from its source. Energy experts recommend a 50/30/10 footcandle ratio for working areas:

- 50 footcandles of light for reading or other close work
- 30 footcandles of light for the area surrounding the work area
- 10 footcandles of light for hallways and similar areas

Footcandles can be measured with a photographic light meter. Basically, three types of lights are available for home use: **incandescent, fluorescent and high intensity discharge (HID).** The incandescent bulb (we think of it as a standard light bulb) is by far the most common source of lighting used in homes in the U.S. It is also the most wasteful.

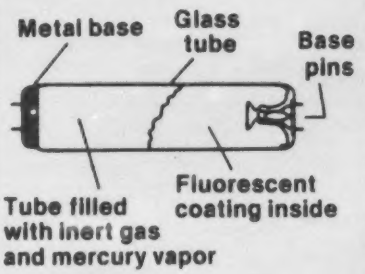
It is estimated that 90 per cent of the energy consumed by an incandescent bulb is given off as heat, not light. It is important to select the right type and wattage for the right purpose.

Incandescent and Fluorescent Lighting

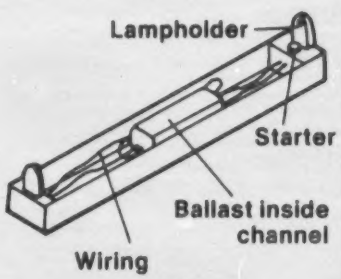
Efficiency increases as the wattage increases. The U.S. Department of Energy gives this example: one 100-watt incandescent bulb has an output of 18 lumens per watt, while a 60-watt bulb produces only 14 lumens per watt. Thus, the substitution of one 100-watt (1800 lumens) bulb for two 60-watt (1680 lumens) bulbs produces more light and uses less electricity.

Another factor to consider in an incandescent bulb is the life span of the bulb, which is measured in hours and is printed on the package. These bulbs have a relatively short life span, and near the end of the lifetime of the bulb the light output has depreciated

Fluorescent Tube Cross Section



Fluorescent Channel



by 20 per cent. Energy, and therefore money, can be saved by replacing darkened bulbs before they burn out.

Long-life bulbs are the least energy efficient. They last from 2500 to 3500 hours; but light output is sacrificed in favor of long life. They should be used only in places where bulb replacement is difficult.

Fluorescent and incandescent lights affect colors quite differently. Incandescent lamps accentuate warm tones—reds, oranges, yellows, while the standard fluorescent bulb used in lamps accentuates cool tones—blues and greens.

Because fluorescent lamps do not depend on the build-up of heat for light, little energy is wasted in the form of heat. Fluorescent lamps are more expensive to install, and although the tubes cost more, they last much longer than incandescent bulbs and probably cost less in the long run. Fluorescent bulbs also use much less electricity to operate—about 1/4 to 1/3 the amount needed to provide equal lighting from incandescents.

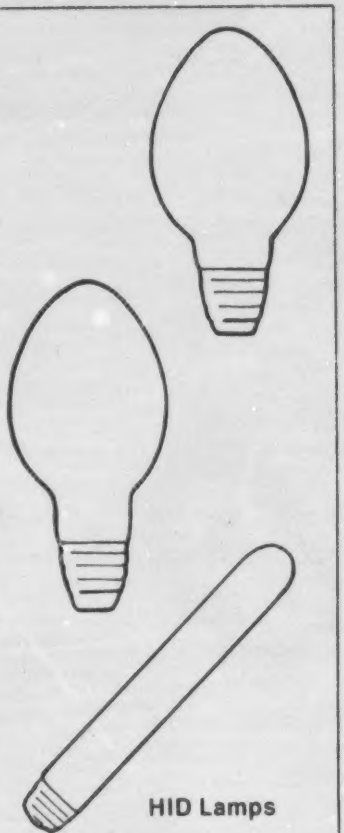
Generally speaking it is more energy efficient to turn off a fluorescent light when not in use. But keep in mind that a fluorescent tube "wears" according to the number of times it has been turned on. Fluorescent lights convert energy to light by using an electric charge to activate gaseous atoms within the fluorescent tube. The charge is sparked in the ballast and flows through cathodes in either end of the tube. The resulting gaseous discharge causes the phosphor coating on the inside of the tube to "fluoresce," and emit strong visible light. Little heat is gained in the process and, therefore, little heat energy is wasted.

Consumers have been reluctant to endorse fluorescent lighting for homes for a number of reasons—mostly aesthetic. Many people object to the cold, stark tones associated with fluorescents, and feel that living under fluorescents is like to working in an office building or factory. However, technology has improved fluorescent lighting so that several types are now available. These fluorescent bulbs are available in cool white, deluxe cool white, warm white and deluxe warm white. Each type has different properties and different levels of efficiency.

Fluorescent Lamp Selection Guide

	Effect on Atmosphere	Colors Strengthened	Colors Weakened (Grayed)	Remarks
Cool white	neutral to fairly cool	orange, yellow, blue	red	blends with natural daylight
Deluxe cool white	neutral to fairly cool	all nearly equal	none appreciably	simulates natural daylight
Warm white	warm	orange, yellow	red, blue, green	blends with incandescent light
Deluxe warm white	warm	red, orange, yellow, green	blue	simulates incandescent light

U.S. Department of Energy



HID Lamps

The deluxe warm white bulb closely simulates incandescent lighting; the deluxe cool white bulb closely resembles natural daylight. The deluxe quality, however, sacrifices some of the efficiency of standard fluorescent bulbs. The table summarizes the color-rendering properties of four types of fluorescent lamps.

New Lighting Technology

Another type of lighting used primarily for outdoor security and safety because it must burn for long hours is the High Intensity Discharge (HID) lamp. There are three types of HID lamps: mercury, metal halide and high pressure sodium. Mercury lamps are the most commonly used outdoor lighting source. They have a low installation cost and a very long life. Where efficiency is more important than color rendition, mercury lamps are a good choice. They come in a variety of wattages.

Metal halide lamps are more efficient, but they are available only in higher wattages, and therefore are used for commercial purposes.

High pressure sodium lights are the most energy efficient light source. Homeowners might use them for outdoor lighting, but their lumen output is too bright for home interiors.

HID lamps have a big drawback because they require from one to seven minutes to fully illuminate from the time they are switched on.

A number of new types of light bulbs have appeared on the market, and more are in various stages of development and marketing. One example is the HID "Halarc™" This bulb uses metal halide technology taken from industrial and commercial lights, and combines it with electronic circuitry. The Halarc™ has high and low settings, it emits as much light as a 50/100/150 watt 3-way light, using about 1/3 of the energy, and has an average life of 5000 hours.

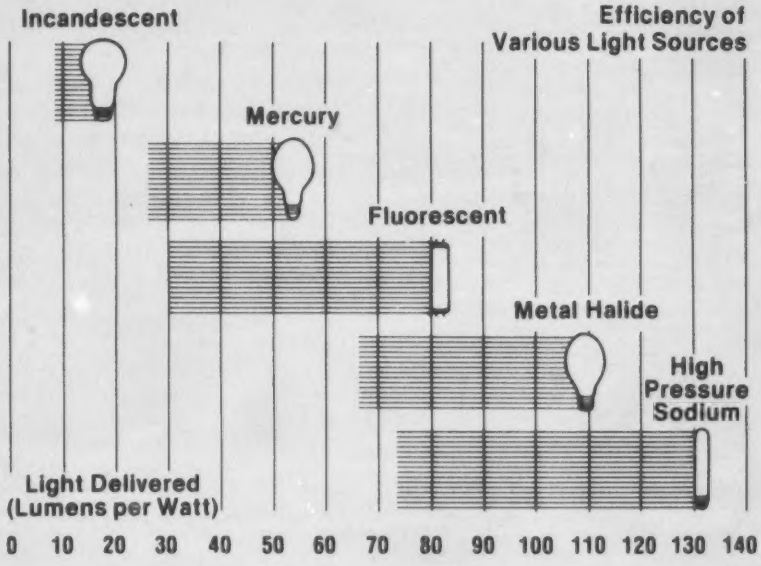
Another example is the "Circlite™" This 44-watt fluorescent ring is 10" in diameter, and resembles a steering wheel with spokes which connect to a round screw-in adaptor which screws into regular incandescent sockets. The "ring" is replaceable and has an average life of 7500 hours, about 10 times that of a 100-watt bulb. Circlite uses an efficient new phosphor which produces a warm light comparable to the appearance of incandescent light. The bulb retails for about $18-20 in 1981.

How light fixtures are placed in relation to the objects that surround them and the purpose of their use is important to energy efficiency. A directional lamp used above a work area gives more illumination for the same wattage than does more general diffused lighting. This is called **task lighting**—lighting only the area where a particular task is to be performed. Examples would be a sewing table, work bench, kitchen counter, etc.

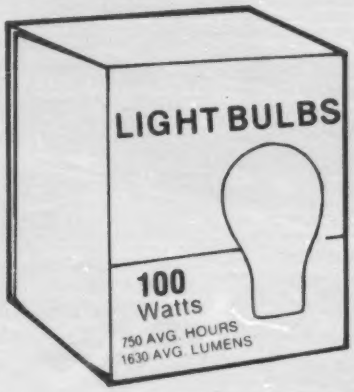
Dimmer switches save energy and are both inexpensive and easy to install. Dimmer controls permit the homeowner to adjust the level of light in a room over the full range, from off to the highest illumination level. Dimmers are especially desirable in dining rooms. There are two types of energy-saving dimmer controls on the market. Another, the reo-stat type, reduces the amount of light while consuming the same amount of energy. Both of the energy-saving types—solid state and variable

automatic transformers—reduce the amount of electricity delivered to the light. Because the bulbs are operating on reduced voltage, the life of the bulb is extended. Dimmer fixtures replace standard light switches and are used primarily with incandescent lights. However, dimming equipment is available for certain types of fluorescent lamps. There are also dimmers on the market which can be attached to table lamps.

The least expensive lighting of all, natural lighting, is also the most energy efficient. Because utility rates continue to increase, an analysis of lighting needs in the home is important.



U.S. Department of Energy



HHF#8
Determining Task Lighting Needs

Draw an approximate floor plan of your home/apartment and show where furniture is located. Indicate areas such as reading chair, sewing table, etc. Then place an X in each spot where lights for a particular task—task lighting—should be located.

HHF#9
Light Bulb Efficiency

Wattage is not a measure of the amount of light given off by a light bulb, but rather how much energy is required to operate it. The amount of light it provides is indicated in lumens. Bulb packages should give not only the wattage, but the lumens produced by the bulb. Using the packaging, compare several bulbs—both incandescent and fluorescent—for their efficiency.

Formula: lumens divided by watts = lumens per watt

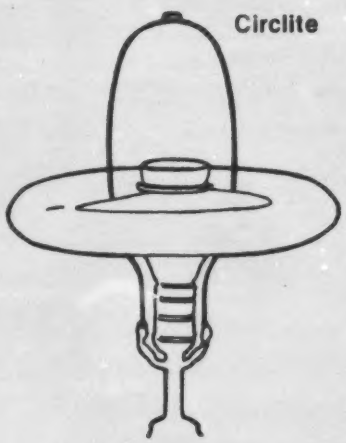
$$\frac{\text{lumens}}{\text{watt}} = \text{lumens/watt}$$

Example: A 100 watt incandescent bulb may yield 1750 lumens which gives the bulb an efficiency of 17.5 lumens per watt:

$$\frac{1750 \text{ lumens}}{100 \text{ watts}} = 17.5 \text{ lumens per watt}$$

Determine the efficiency of the following bulbs:

1. 100 watt fluorescent bulb:
2. 40 watt fluorescent bulb:
3. 100 watt incandescent bulb:
4. 25 watt incandescent bulb:
5. 75 watt incandescent bulb:
6. a bulb you have found at home: _____ watts
   _____ lumens
7. Which type of lighting is more efficient—incandescent or fluorescent?
8. Is it more efficient to buy four 25-watt or one 100 watt incandescent bulb?



Circlite

HHF#10
Lighting Cost Comparisons

Using the local power company's electrical rates for a kilowatt hour (kWh) of electricity, compare the operating costs (plus purchasing price) of two kinds of bulbs. A formula to determine the total cost of operation based on the life expectancy of the bulb is included, plus an example.

It is important to remember that this is not a "scientific" experiment, but rather a **general** cost comparison. For the purposes of this activity use the same electrical rate for the entire life of the bulb (which, considering inflation and rising energy costs, is unlikely), and the same purchase price for succeeding incandescent bulbs (also unlikely for the same reasons). Many other factors concerning efficiency of the individual bulb and electrical system may vary. The two bulbs listed have approximately, but not the exact same, lumen ratings.

Formula:

$\frac{\text{Watts}}{1000}$ = _____kw X 1 hr = _____kWh X cost/kWh

= ¢/hour to operate X life expectancy of bulb in hours

= total cost to operate + purchase price = TOTAL COST

Example: 40 Watt bulb, (455 lumens) average life 1500 hours

$\frac{40}{1000}$ = .04 kW X 1 hr. = .04 kWh X .04¢/ kWh

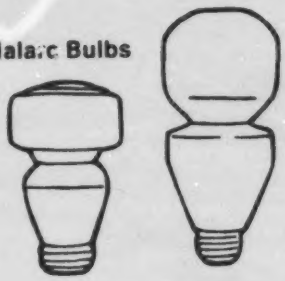
= .0016¢/hour X 1500

= $2.40 + .69¢ purchase price = $3.09 Total Cost

1. Circlite — purchase price $18. 44 Watts, 1750 lumens, 7500 hours life expectancy
   100 Watt incandescent bulb, purchase price .79¢, 100 Watts, 1710 lumens, 750 hours life expectancy

2. How many 100 watt bulbs would be needed to cover the same life span as the Circlite? Discuss your results. Which bulb is the better "buy," and for what reasons?

Halogen Bulbs



HHF#11
Lighting Word Scramble

Unscramble the words below. Each word is light-related.

selnum _____

truflescone _____

teendiscannc _____

tingglih _____

tatw _____

crumyer _____

palm _____

ridsemm _____

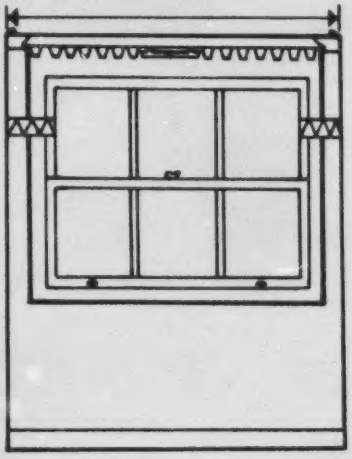
tilkawtoruoh _____

kastgthiignl _____

Answers: (when duplicating for students cover this portion!)
Lumens, Fluorescent, Incandescent, Lighting, Watt, Mercury, Lamp, Dimmers, Kilowatthour, Task Lighting.

27

Housing



Lesson 6 — Draperies and Window Treatments

Objectives: Upon completion of this lesson students will be able to evaluate various window treatments for their energy efficiency and plan window treatments for both summer and winter.

Background Information: Attached.

Activities:

HHF #12 — Class visit to an interior designer or the drapery department of a department store. Check the R-values of drapery fabrics and see the various types of treatments available. (Jr, Sr, Adult)

HHF #13 — Selecting Window Treatments (Attached) (Jr, Sr, Adult)

HHF #14 — Designing a Window Treatment (Attached) (Jr, Sr, Adult)

Resources: "Window Treatments for Energy Efficiency," Nebraska Cooperative Extension Service bulletin, 1980.

"Window Wizardry," by Cathy Eberlein, Energy Horizons, Minnegasco publication, Fall 1978.

"Summer Energy Savings . . . Made in the Shade," Texas A & M University, Volume 6 Number 7, June 1980.

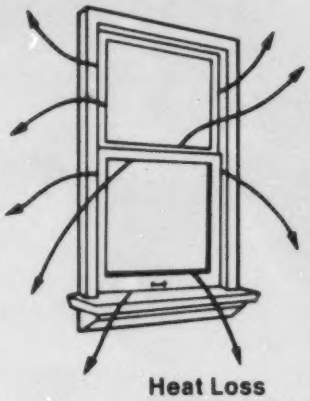
"Rods and Rings and Other Things," Kirsch Company, Summer 1979.

"Shades and Shutters," Home Energy Digest, 1980.

Suggestions: Demonstrate the principles of measuring for curtains and draperies.

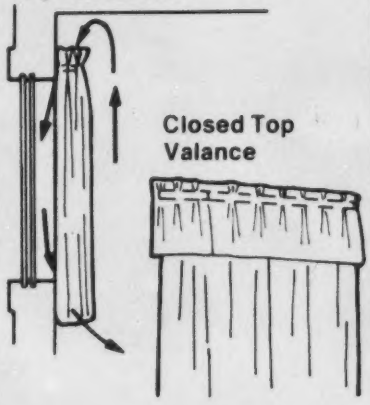
Consider making new curtains for the Home Economics Department if new curtains are warranted. Consider the alternatives and select the treatment and materials with energy management in mind.

Obtain samples of drapery fabrics and pictures of window treatments from department stores, drapery shops, catalogs, magazines, manufacturer's literature and the Cooperative Extension Service.



Heat Loss
by Infiltration

Heat Loss
by Convection



Lesson 6 — Draperies and Window Treatments

According to a study by the Department of Housing and Urban Development, a home without windows or outside doors would require 70 per cent less heating equipment and fuel, and 46 per cent less air conditioning equipment and power. Of course homes without windows are not very desirable—we depend on windows to provide light, ventilation and a view.

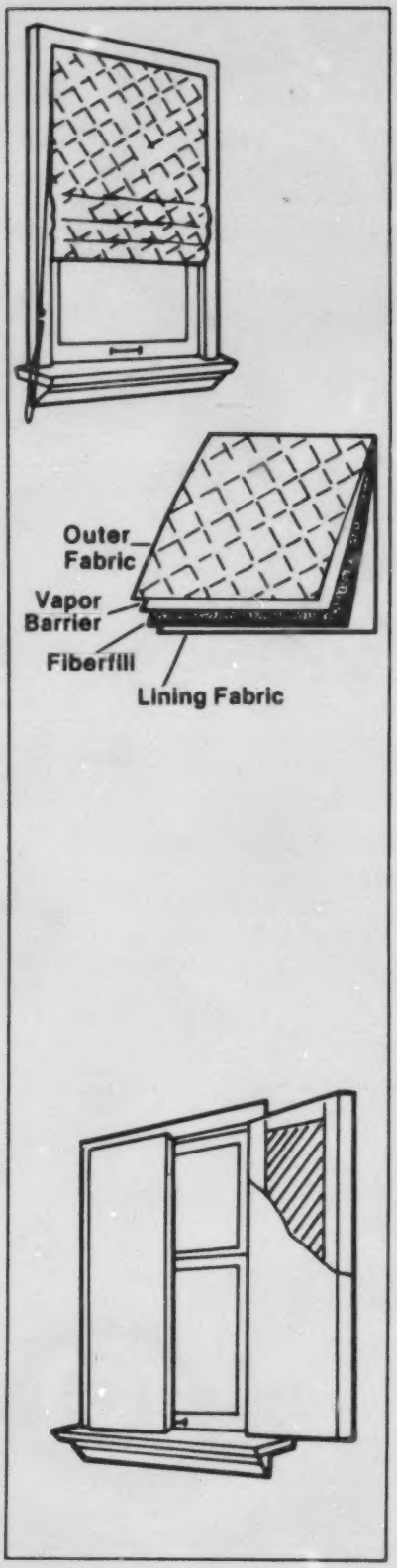
Experts say that as much as half of the heat lost in a home goes out the windows. This heat loss occurs in a number of ways: **convection,** the cooling of warm air as it moves across a cooler surface—the window; **conduction,** the traveling of air from a warm space to a cold space as from the inside to the outside of the house; **infiltration,** air leaking and drafts around windows and window frames which can be checked by caulking and weatherstripping; and **radiation.** Radiation occurs when a warmer surface is given off to a cooler surface. Radiation occurs when the body heat of a person sitting near a window escapes to the cooler glass surface.

There are a number of things which can be done in order to cut down on window heat loss. An energy efficient window treatment traps air between itself and the window. This trapped air serves as an insulator. But in order to trap this air it is necessary to create a tight seal all the way around the window. Normally, draperies are hung a few inches from the wall (usually on the popular 'decorator' rods). When these draperies are closed, a draft flow forms (convection current). Warm air off the ceiling is drawn inside the drapery and down over the window where it is cooled. This cooled air then flows back into the room from under the draperies. To prevent this air flow, and to create a pocket of trapped air to act as an insulator, construct a decorative valance or box over the top of the draperies. Hang the draperies so they touch the floor and extend beyond the window on all sides. Make sure the draperies touch the wall at each side and close tightly at the center. A small magnet or Velcro™ strip sewn to the center edges of the draperies will help keep them closed. Instead of a valance or box over the draperies, the draperies could hang so they touch the ceiling.

According to a Georgia research study, draperies sealed all the way around the window and at the center overlap, and hung on a double-glazed window, reduced window heat loss by as much as 21 percent compared to the same window with opened draperies.

Two layers of draperies and detachable liners improve the thermal protection. On sunny winter days, open draperies to take advantage of the sun's warm rays to warm a room. To insure maximum sunlight entry, make sure draperies clear the entire window.

In selecting *drapery fabrics*, tightly woven, fairly heavy or bulky fabrics provide the best insulation for energy conservation. White *linings* have a tendency to reflect sunlight back into the glass, and so are beneficial in the summertime to cut air conditioning costs. There are a number of insulated linings on the market. Linings which aren't too heavy can be attached to the draperies with



velcro or other fasteners or can be made to slip over the drapery hooks.

Window *shades* which cover the entire window will add another layer of protection. Shades mounted inside the window frame and sealed tightly are effective in cutting heat loss. A variation of the basic shade is the Roman shade, which is several layers of fiber batting, plus a vapor barrier, sandwiched between an outer fabric and a lining. This is the "layered look" for windows, with the same purpose as the "layered look" in fashions. When mounted with a close fit over the window, the Roman shade can be very energy efficient. Venetian *blinds* help reflect the sun's rays in summer but offer little insulating value in winter. Some blinds have a fabric side which may offer a little insulation. An effective and popular variation of the Roman shade is made of woven wood. Mounted outside the window, the woven wood provides maximum efficiency against heat loss. Closed weaves are the most effective. These shades come in a wide variety of colors and designs.

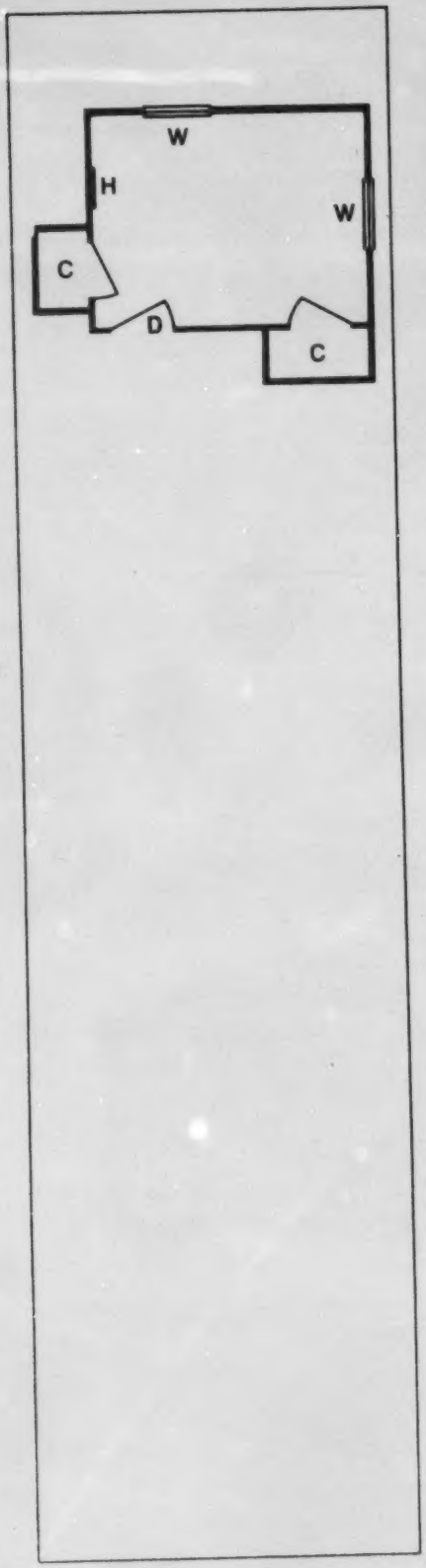
Many European homes are characterized by their shutters. The shutter trend has also caught on in the United States. Some shutters are located outside the window, some inside. Standard interior wood shutters do not have a high insulation value, mainly because the louvers and the place where the two shutters meet make it difficult to achieve a tight fit. Shutters made to be used with fabric inserts can have rigid board insulation added to them provided it is covered with an appropriate flame retardant material. The same insulation, such as polystyrene, can be covered with flame retardant fabric and placed inside basement windows. Basement windows are often overlooked for thermal protection.

In planning window treatments, the goal for energy management is to trap air between the window and the window treatment. If this is done effectively, the window will become quite cold in winter. Therefore, condensation may become a problem. Watch for mildew or deterioration of the window frame. This is why a vapor barrier should be incorporated into a good window treatment. A layer of 4 mil plastic, just under the outer layer of window treatment, will provide an adequate vapor barrier. This makes Roman shades, insulated shutters and panels especially attractive for their energy efficiency qualities.

Awnings can reduce summer solar heat gain by up to 65 per cent on south-facing windows and 77 per cent on west-facing windows, according to the National Bureau of Standards. Awnings provide shade for individual windows, and permit air circulation and ventilation.

While the homeowner must be concerned about moisture build-up in winter, he/she must also be concerned about heat build-up in summer. Air-tight windows and window treatments can cause the glass to become extremely hot. This makes some sort of exterior shade very desirable.

Window treatments can make a significant contribution to thermal efficiency. Carefully consider the cost and the savings in order to make your best energy management decisions.



HHF#13
Selecting Window Treatments

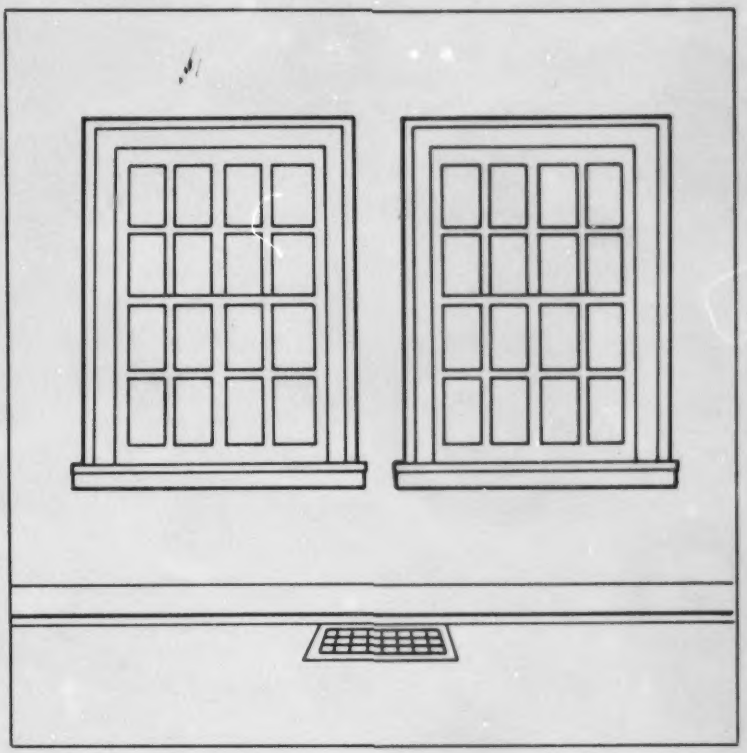
Draw a floor plan of your bedroom (or another room in your home), indicating where windows (W), doors (D), closets (C) and heat ducts (H) are located. Measure the windows. Then design an energy efficient window treatment for the window(s). With remnants of fabric, construct a small-scale model of the window treatment you have designed.

HHF#14
Designing a Window Treatment

Windows and heat sources frequently live side-by-side. Sometimes, especially in older buildings, these heat sources are not especially attractive. It is a problem to make maximum use of the window and the heat source. In the example, this is the only heat duct in the room. The window area shown below faces east and is in the living room of the home. They are single pane windows and do not open. Sketch the flexible window treatment you would use.

Describe the fabric or material you would use.

What might be done to treat a south-facing sliding glass door?



Lesson 7 — Psychology of Room Arrangement, Color and Texture

Objectives: Upon completion of this lesson students will be able to list some ways psychology plays a role in thermal comfort.

Background Information: Attached.

Activities:

HHF #15 — Creating Thermal Effects with Furnishings. Assemble samples of carpeting, drapery and upholstery fabrics and wall coverings, and demonstrate how various effects can be achieved by mixing colors, textures and styles. (Jr, Sr, Adult)

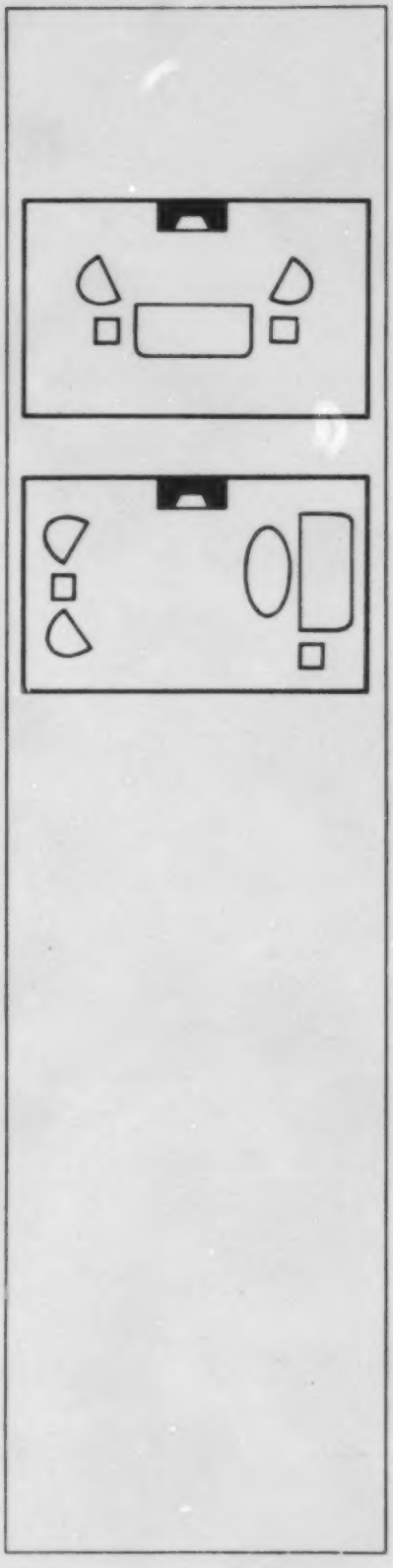
HHF #16 — Arranging Furniture to Achieve Thermal Comfort. Use doll house furniture in a 3-sided box decorated with contact or wall paper. By moving the furniture, create warm, cool, roomy and cozy effects. (Jr, Sr, Adult)

Resources: "Facts about Energy Efficient Home Decorating," Energy fact sheet, Minnegasco.

Suggestions: Show the students various colors of fabric and ask them to describe their feelings with each color. Do the same with various textures of fabrics and/or wall coverings.

Look at pictures of rooms from decorating magazines. Discuss which rooms reveal 'warm' and 'cool' feelings. Discuss how each room could be changed to achieve the opposite effect.

Visuals: (Fig. #6 & Fig. #7). Compare the psychological aspects of decorating in these two living rooms. Add colors and/or accent colors to achieve various thermal effects.



Lesson 7— Psychology of Room Arrangement, Color and Texture

It may seem strange that psychology plays a role in energy conservation. But it does! The room that looks warm, feels warm.

Different atmospheres—thus different thermal effects—can be achieved in a room arrangement. Though the rooms shown are the same size, the one room seems cozy and warm with the furniture positioned close to the fireplace. The room other appears open, airy and cooler because the furniture has been moved to the walls. The room that looks warm will help (psychologically) to make the occupant feel warm.

However, in arranging furniture it is important to avoid blocking any intake or outlet vents. In winter, arrange the seating away from windows if possible.

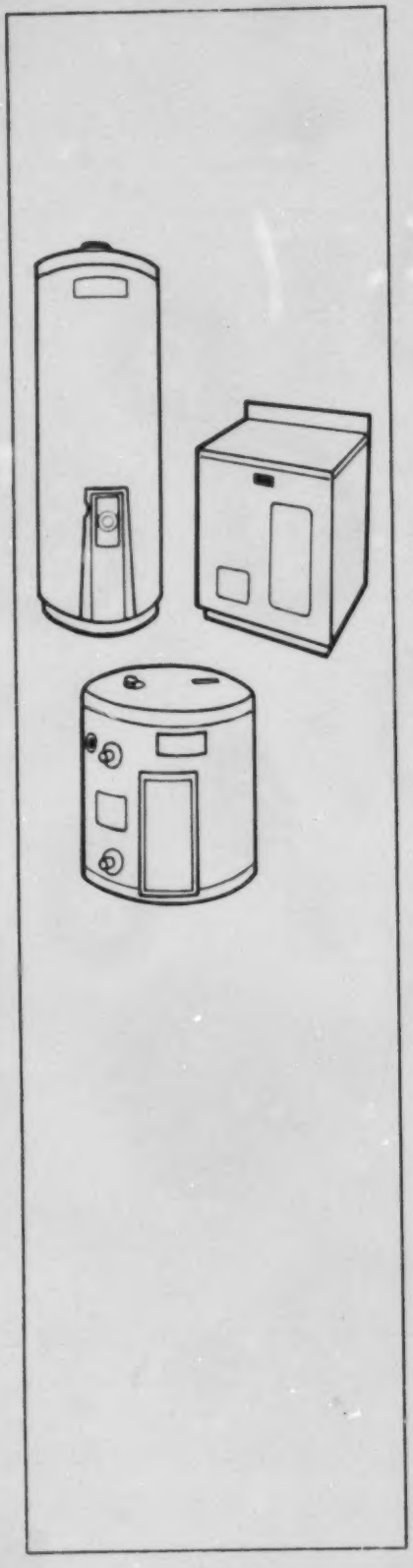
Furniture selection is also important in creating warm or cool effects. Multi-purpose units, storage units or cabinets placed along the outside wall can add insulating effects. Upholstered furniture gives a warmer feeling; metal furniture or chairs with open arms give a cool feeling. Carpeting adds a warm look and also insulates. A wood or tile floor gives a cool look. Area rugs will 'warm up' wood or tile floors in winter.

The selection—and psychology—of color adds another dimension to the challenge of achieving thermal efficiency at home. Color means different things to different people. Red, to a child, may conjure visions of a little red wagon. The same color, to a Russian, brings images of a ruby red star atop the Kremlin Wall in Red Square in Moscow. And red to a Nebraskan probably means football!

Because we want to feel warm in winter, we need to achieve a look of warmth. This can be done by using warm colors—reds, oranges and yellows—in decorating. The opposite is true in summer; we want to achieve a feeling of coolness, and this is done by using cool colors, such as blues and greens.

However, most of us can't afford to redecorate twice a year; indeed most of us can't redecorate more often than every few years. But there are things we can do to accomplish part of our goal. Choosing a light, neutral overall color scheme offers more room for accents and is more energy efficient because it will reflect light. Furnishings which can be dressed up or down with cool or warm accents—a bright red afghan in winter or a pale blue sofa pillow—will offer versatility. Slipcovers or furniture throws can be changed with the season.

Texture also plays a role in thermal efficiency and comfort levels. Soft-textured upholstery or drapery fabrics (such as velvet or corduroy) have a warm feeling about them; textured wall coverings also add a feeling of warmth. Use of a wall mural can add dimension and warmth as well. Flat or vinyl wallcoverings and flat upholstery and drapery fabrics create a cool effect. Shiny surfaces create a cool or 'formal' feeling. These are just some examples of how our comfort levels can be altered psychologically.



Lesson 8 — Efficiency Through Hot Water Use

Objectives: Upon completion of this lesson students will be able to describe some ways hot water use can be reduced in the home without making extreme sacrifices.

Background Information: Attached.

Activities: Attached

HHF#17 — Showers vs. Baths

HHF#18 — Measuring Hot Water Temperatures

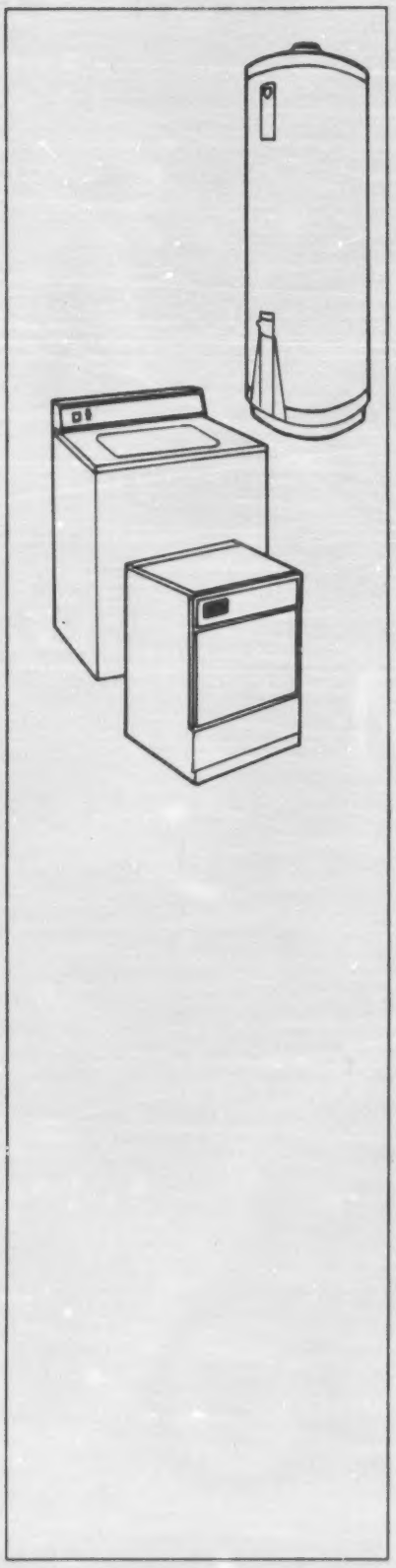
Resources: "Tips for Energy Savers," FEA, now U.S. Dept. of Energy, 1977.

"Easy on Energy—at Home," Nebraska Cooperative Extension Service NebGuide #78-96, 1978.

"Put Your House to Work Saving Money for You!", Exxon Corporation, 1979.

"Winning Ways with Water," Nebraska Cooperative Extension Service NebGuide #77-86, 1977.

Suggestions: Using the appliance-labeling Energy-Guides, compare the efficiency of various hot water heaters in a department store, hardware store or plumbing dealership.



Lesson 8 — Efficiency Through Hot Water Use

Most families spend from 10-20 per cent of their monthly utility bills on hot water, with 15 per cent being the national average. The costs for hot water vary by the amount of water used, the type of water heater—electric or natural gas, the thermostat setting and the temperature of the water as it enters the house (Nebraska ground water averages 55°F).

As Americans we have become accustomed to having hot water at our finger tips constantly—even in places like public restrooms, where it isn't absolutely necessary. It takes a small amount of energy to run motors, but a great deal to heat things. In washing clothes ot tales about 5 per cent of the energy per load to do the agitating, spinning and tumbling, but 95 per cent of the energy for water heating. This explains why things like furnaces, ranges, clothes dryers and water heaters are some of the biggest energy-users in the home.

To understand how hot water can take such a big bite out of the family energy budget, let's look at a Pennsylvania State University study of how water is used by a typical American family of four.

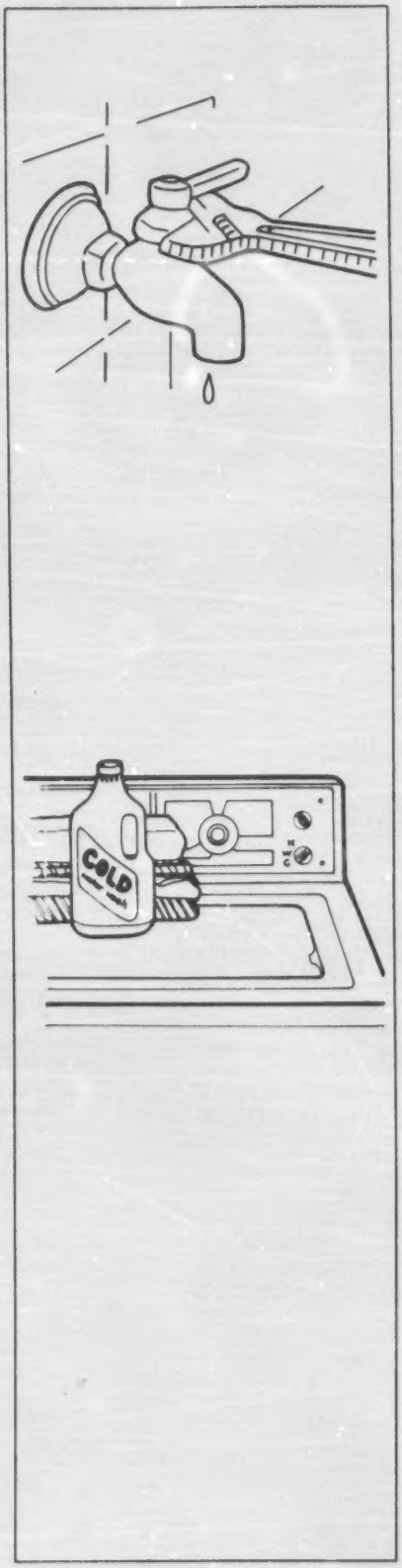
Use	Gallons/per Day
Dishwashing	15
Cooking, drinking	12
Utility sink (washing hands, etc.)	5
Laundry	35
Bathing	80
Bathroom sink	8
Toilet	100
Total	225

Besides using so much hot water, we have a tendency to keep it too hot. Hot water is an expensive convenience. For each 10 °F. reduction in temperature setting on the water heater, you can cut hot water energy consumption by 5 percent. Many water heaters are set at 140°F. or higher. Most experts recommend that homes with a dishwasher maintain the 140°F. temperature because the dishwasher uses water directly from the heater. A temperature of 120°F. is generally considered adequate for all other purposes.

If you are in doubt about the water temperature, draw some water from the faucet nearest the water heater and check it with a thermometer. In building or remodeling, locate the water heater(s) near points of greatest use.

Water heater maintenance is important to ensure safe and efficient operation of the heater. It is important not to let sediment build up in the bottom of the heater. Several times a year—or better, once every month—flush the sediment out of the heater by drawing several buckets of water from the tank through the water heater drain faucet.

If the water heater is several years old and not particularly well insulated, some heat is being lost. Many experts recommend insulating the hot water tank and also insulating pipes which carry the hot water. New hot water heaters are available with thick



insulation on the shell. While the initial cost for a well-insulated hot water heater is higher, energy savings over the years will more than repay the investment. New gas water heaters are designed with electronic ignition to eliminate pilot lights and with flue dampers to reduce stack losses.

It is also important to repair leaky faucets—both hot and cold water faucets. One drop a second can waste as much as 60 gallons of water in a week.

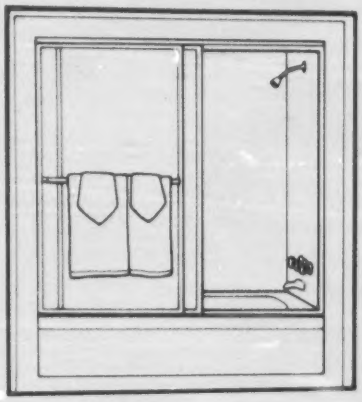
There is room for conservation in just about every area we use hot water. According to the Penn State study, a great deal of water is used for bathing. There has been a great deal of debate as to whether showers or baths are more efficient. A tub holds 30-40 gallons of water (15-20 gallons of hot water) and a shower releases 6-8 gallons (3-4 gallons of hot water) a minute. Some experts say a 5-minute shower is the break-even point. Shorter showers *do* save money.

However, savings can be achieved in the shower by installing a flow restrictor in the showerhead. The restrictors reduce the flow of water from 6-8 gallons a minute to 2-3 gallons a minute, and good quality restrictors work without sacrificing the hard spray that many people like. There are two basic kinds of restrictors. One is a small device for $1 or less that fits between the showerhead and the arm and can be installed by the do-it-yourselfer. A completely new energy efficient showerhead ranges in price from $4-25.

Flow restrictors can also be used to reduce the flow of hot water that comes through a faucet. Some restrictors aerate the water so that the pressure is still high even though less water is used.

Whenever possible, do laundry with warm or cold water. Many cold water detergents are available. It takes three times as much in energy to operate the washer with a hot wash/warm rinse as with a warm wash/cold rinse. Cold water rinses are satisfactory for almost all types of laundry. Most automatic washers provide options for using less water with smaller loads with tub baskets or water-level settings. The less hot water used, the more energy saved.

The dishwasher is also an appliance where hot water is the big energy user in its operation. When operating the dishwasher, five percent of the energy is required to run the motors 85 per cent to heat the water by the hot water heater, and 15 per cent to operate the drying coils. The average dishwasher requires 16 gallons of water per wash. Some newer models have short cycles that use less hot water. The U.S. Department of Energy reports that if every dishwasher user in the country cut out just one load a week, we'd save almost 15 million kilowatthours of electricity every day or the equivalent of about 9000 barrels of oil a day. Hot water costs too much to waste—it must be used wisely.



HHF#17
Showers vs. Baths

The next two times you bathe, try the following experiment. (Note, this experiment doesn't work with showers which are separate from the bathtub).

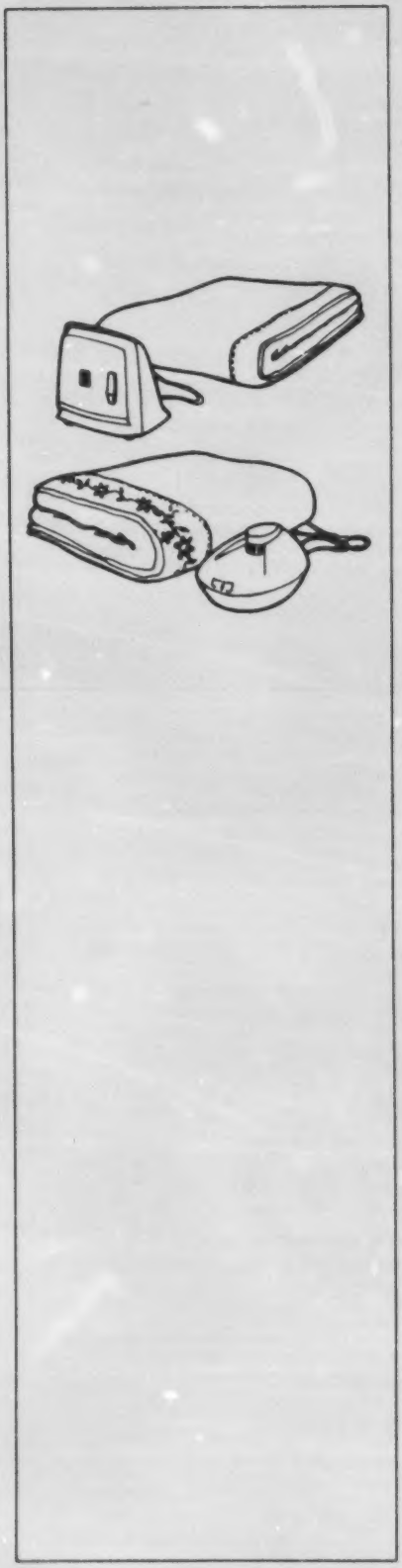
First, bathe in the tub as you normally would. Measure the water depth at one particular point in the tub.

The next time you bathe, put the plug in the bathtub but use the shower. Allow the water to accumulate in the tub. Again, measure the water depth at the same point as before.

Compare the two depths. What comparisons can you make between the two methods of bathing?

HHF#18
Measuring Hot Water Temperature

Draw some water in a cup from the faucet nearest your hot water heater. Insert a household thermometer into the water. Wait at least 60 seconds. Read and record the temperature. Do you need to adjust the hot water heater based on what you have learned in this lesson?



Lesson 9 — Efficiency Through Portable Appliances

Objectives: Upon completion of this lesson students will be able to identify the advantages of using an electric blanket while turning the thermostat back 10° or more at night. They will also be able to give thoughtful consideration to the purchase and use of portable appliances.

Background Information: Attached.

Activities:

HHF #19— Examining Portable Appliances

Resources: "Your Electric Blanket," Nebraska Cooperative Extension Service NebGuide #78-90, 1978.

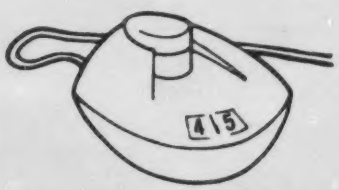
"How to save energy without being left in the cold," Northern Electric Company, Chicago.

Suggestions: Secure samples of electric blankets from a department store and compare the construction, fiber content and wattages.

Have students bring a fuel bill for a winter month when the family didn't reduce the thermostat setting. Have students figure 11 per cent of the fuel bill to learn what savings could be made by a thermostat setback; then have them figure the operating costs of electric blankets in place of the fuel that normally is used to keep warm.

Visuals: (Fig. #8) Energy Data of Home Appliances

Lesson 9 — Efficiency Through Portable Appliances



The primary goal of the home occupant on a cold blustery evening is to keep warm—a goal that appears to be in direct contrast to the "dialing down" recommended for thermostat settings at night. However, both goals can be achieved. The thermostat can be set back 5-10° from the daytime temperatures, and you can still be warm at night by using an electric blanket. *Because setting the furnace thermostat back can reduce heat costs (highest energy cost in the home), we have given the electric blanket the major focus of this lesson.*

According to Northern Electric Company, Chicago, an electric blanket used at a mid-point setting in a room with a 62° temperature for 8 hours, will cost less than a kilowatt hour of electricity. That's 3½-5¢ a night per electric blanket, depending on the electric rates in your area.

Compare that to the fuel saved by setting back the thermostat. The house is much like an insulated box—cooled in summer and heated in winter. The farther the inside temperature strays from the outside temperature, the more energy it takes to maintain a comfortable temperature inside.

A Department of Energy chart reveals that setting back a thermostat 8-hours a night by 10° from the daytime setting will achieve an 11 per cent reduction in fuel costs. That statistic is listed for the city of Omaha, a representative city for this area of the country. If 11 per cent of the fuel bill can be saved by a 10° cutback in temperature, and replaced with a few cents a night for every electric blanket in the house, then a genuine savings can be realized.

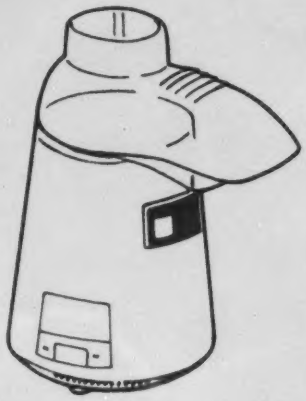
The heat generated by an electric blanket is controlled by a thermostat switch that operates much the same as the furnace thermostat. The blanket turns off and on through the night as the temperature of the room changes. The higher the control is set on the blanket, and the colder the temperature of the room, the longer the blanket will stay on.

Most electric blankets on the market are made of acrylic, polyester or blends of the two fibers. These fibers offer good insulation, durability and minimum shrinkage.

When buying an electric blanket look for the Underwriters' Laboratory Seal (UL) on the blanket label and control. This seal means that the electrical parts meet safety standards, and that the fabric has passed the flammability flame-spread test. Most blankets have warranties of 2-5 years.

With proper use and care, the electric blanket will last several years. Electric blankets are available in twin, full, queen and king sizes. Available also is the option of having dual controls in the larger sized blankets. One half of the blanket is controlled by each control; the controls work independently of one another, so one side can be warm, and the other low or off completely.

To launder an electric blanket follow the manufacturer's directions for best results. Electric blankets are usually not dry cleanable, because the solvents used in cleaning will damage the wiring and insulation.



Other Portable Appliances

There are numerous other appliances on the market. A look at the list of appliances in the resource section of this book shows how many appliances there are. *And the list is far from complete!* Many of the small appliances listed can be used in place of major appliances, to save energy. An example of this is the electric fry pan, which may be used in place of a range burner. Many of these appliances are "convience" appliances and have limited function. Examples might include a hot air corn popper, a yogurt maker and a hot dog cooker.

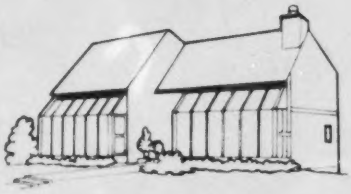
When considering appliances, ask yourself several questions. Will an appliance already in the home do the same tasks? Do you *need* it? Do you have a place to store it? Is the appliance made by a reputable manufacturer with U.L. approval on the appliance and on the cord? Is it designed for safety and easy cleaning? Is service available? Do you have electrical outlets where the appliance will be used? *Will the appliance make a contribution to energy conservation?*

These and other questions are important to consider so that the appliances serve a purpose and not just a sudden desire. Some thoughtful consideration before buying will make you a better manager of electricity in your home.

HHF#19
(Fig. #8)

Examining Portable Appliances

1. Examine the list of appliances (in the resource section) and identify those which could be used for multiple purposes.
2. Identify those that are limited in use.
3. Which ones would you consider faddish? What other appliances can you think of which are not on the list, but are also in this category?
4. What other popular appliances are on the market now?
5. Which of the listed appliances are the highest energy users? Of these, which are multi-purpose and which are limited in versatility?
6. What appliance would you like to buy?



Lesson 10 — Alternate Housing

Objectives: Upon completion of this lesson students will be able to list and describe three types of alternate housing and some advantages and disadvantages of each.

Background Information: Attached.

Activities: See Suggestions

Resources: "The Passive Solar Energy Book," by Edward Mazria, Rodale Press, Emmaus, Pa., 1979.

"Earth-Sheltered Housing Design — Guidelines, Examples and References," prepared by The Underground Space Center, University of Minnesota, Van Nostrand Reinhold Co., New York, 1978.

The Earth Shelter Handbook, by Tri/Arch Associates, Published by Tech/Data Publications, Milwaukee, Wisc., 1980.

"Nebraska Energy Saving Manual," Nebraska Energy Office, 1979.

Suggestions: Invite a construction engineer, design engineer or architect to class to discuss trends in housing design. Ask about advantages, disadvantages, costs and energy savings.

Plan an alternate housing field trip—visit earth-sheltered, active solar and passive solar homes.

View the film, "Grass on the Roof," (28 min.) by Film Art Products, Inc.

Lesson 10 — Alternate Housing*

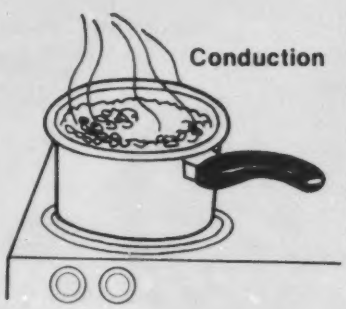
Scientists warn us that supplies of fuel, the ones most common to us, are in very limited supply. Indeed, the National Academy of Sciences suggests that within the next century we shall run out of oil and gas, and within the next two-to-three hundred years we shall run out of coal. So it is no wonder that a great deal of attention has been put on developing alternative sources of energy and housing.

We'll take a brief look at three of the prominent alternatives being used in housing—methods which are in various stages of development, experimentation and use. These alternatives are passive solar, active solar and earth-sheltered designs.

The sun is a star and it is the source of the energy necessary to support life on earth. Yet only a small percentage of its tremendous energy reaches the earth's atmosphere. Even then, much is lost through filtering and reflection in the earth's atmosphere. Yet despite all this, the amount of solar energy delivered to the earth every day is thousands of times greater than man's total daily use of energy for all purposes!

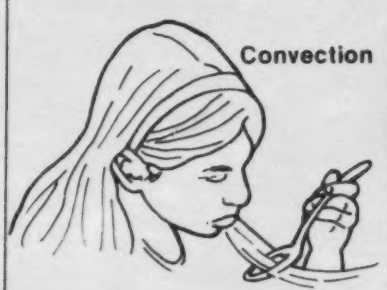
You can no doubt remember returning to your car on a clear but cold winter day and finding the inside of the car surprisingly warm. This is an example of passive solar heating. Solar energy was transmitted through and trapped by the windows and absorbed by materials inside the car.

But to better understand the basics of solar energy, let us first consider the ways heat is transferred. When a material is heated by the radiated heat of the sun, it tries to achieve an equilibrium that is a balance with its surroundings through three basic heat transfer processes:



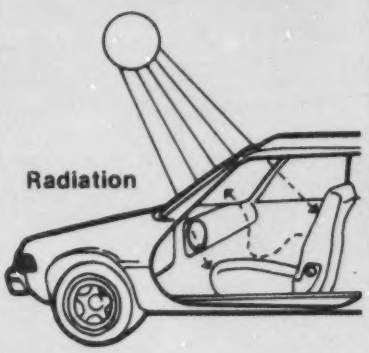
1. **Conduction** — As solar radiation is absorbed by a material, the absorbed energy redistributes itself as it is passed among molecules. Conduction is, then, the process by which heat energy is transferred among molecules within a substance or between two substances in physical contact, by direct action of the molecules. As the molecules on the surface are warmed by solar radiation, they bump into adjoining molecules and in the process pass along some of their energy. Through this dispersing—or *conduction*—of the heat, the material takes on a more uniform temperature.

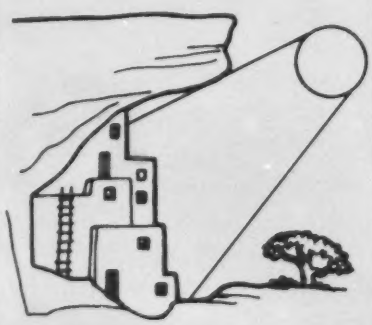
Materials have varying rates of conductivity depending on their ability to absorb heat and pass it from their surfaces to their interiors. Metal as compared to paper has the ability to absorb heat and pass it on to the interior much faster than does paper. So metal feels colder to the touch than paper at the same temperature.



2. **Convection** — Convection is defined as the transfer of heat between one piece of matter and another, such as a liquid or solid surface and a moving fluid such as air. It can also be the transfer of heat by movement of the molecules from one point to

*This lesson on solar energy is based largely on the book "The Passive Solar Energy Book" by Edward Mazria, Rodale Press, 1979.





another point in a fluid. In this process, heat always moves from warm to cool. There is no such thing as "cold." What seems "cold" simply has less heat. As less hot (cold) molecules of a fluid such as water or air come into physical contact with a hotter (warm) surface, some of the energy (heat) at the surface of the material is transferred to the adjacent fluid molecules. And in this method of heat transfer, the greater the temperature difference between two substances, the more heat will be transferred. As the fluid is warmed, it expands, becomes less dense and rises.

As the warmer molecules rise again, for instance, they are replaced by colder molecules. This results in a continual movement of the fluid, warmer toward the top. When heat alone is responsible for this movement, (no stirring, pouring, etc.), the process is called natural convection.

The convection process naturally also works in reverse. When a warm fluid comes into contact with a cool surface, the warmer molecules transfer some of their heat to the cool surface, become cooler (heavier) and sink. For example, warmer air which comes in contact with a cold glass window produces a downdraft of cool air toward the floor at the window.

3. **Radiation** — At this point you have probably figured out that molecules move (vibrate) more rapidly, the more heat they have. So if you add "heat" to a substance, you simply cause its molecules to vibrate more rapidly.

Because all molecules vibrate, all materials constantly radiate thermal energy in all directions ("cold" materials radiate very little, "hot" ones radiate a lot). The amount of thermal energy a material radiates depends on the temperature of the radiating surface and of the emitting quality of the surface. Common construction materials are usually good emitters of thermal radiation. Not all materials, however, absorb thermal radiation readily. Some materials tend to reflect it.

The ability of a surface to reflect thermal radiation will depend upon its density and composition of the surface rather than on its color, although the color may be an indicator for receptivity to color (light) energy. In general only highly polished or shiny surfaces, such as aluminum foil, reflect large amounts of the thermal radiation they intercept. Glass, which allows practically all the visible radiation striking its surface to pass through, will absorb most of the thermal radiation it intercepts. This property of glass makes it highly desirable for use in collecting solar energy. Trapping heat in this manner is also known as the "greenhouse effect." Our automobile sitting in the sun is a good example of this method of heat transfer and collection.

Although we often speak of solar energy as being a *new* source of energy, solar energy is really only a new term for an old idea. You can remember your studies of Indian tribes who lived in the southwestern part of our nation. Their homes were built of adobe. Adobe absorbs heat during the days and releases it slowly by conduction through the walls and by convection from to the air at night as the interior temperature begins to fall. Earlier people in the Southwest cut homes out of cliffs where natural overhangs blocked out most of the intense high-angle summer sun's rays. These dwellings usually faced south to capture the maximum amount of low angle winter sun.

Active and Passive Solar Designs

Technologically there are two approaches to utilizing solar energy today—active and passive solar systems. **Active** solar energy systems use hardware and mechanical equipment to collect and transport heat. These systems work best when carefully designed with complex and sophisticated solar collectors. Active solar systems are usually installed at the time of construction and involve collectors (usually mounted on the roof of the building) and a separate heat storage unit (rock bin, water tank or combination of the two).

Water or air, pumped through the collector, absorbs heat and transports it to the storage unit. This stored heat is delivered to the rooms in the building by a mechanical distribution system. The active systems generally use as electricity to power the fans and pumps which make the active solar system work.

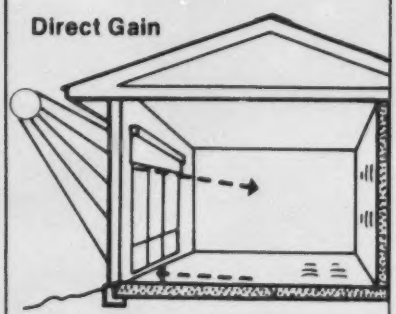
Passive systems, on the other hand, collect and transport heat by non-mechanical means. This means that the thermal energy flows in the system by natural means such as radiation, conduction or convection. The building materials are a component of the system. There are generally no separate collectors, storage units or mechanical elements. Passive systems require two basic elements: *south-facing glass* or transparent plastic for collection, and *thermal mass for heat* absorption, storage and distribution. The ratio between the amount of collector area (glass) and mass (stone, brick, etc.) is important in achieving comfort.

Solar energy experts speak of three types of passive systems: direct gain, indirect gain and isolated gain.

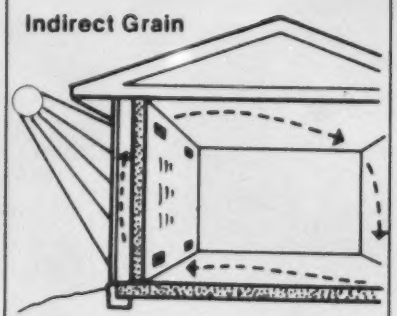
1. **Direct gain** — In direct gain of heat the actual living space is directly heated by sunlight. When the space is used as a solar collector, it must also contain a method for absorbing and storing enough daytime heat for cooler periods (i.e. at night). In the direct gain approach, the space becomes a live-in solar collector, heat storage and distribution system all in one. In direct gain systems, there must be an expanse of south-facing glass and enough thermal mass, strategically located, for heat absorption and storage. South-facing glass is exposed to the maximum amount of the sun's rays in winter and a lesser amount in summer. Because a portion of this solar heat gain must be stored in order to be used at night or during cloudy days, the floor and/or walls must be constructed of materials capable of storing heat. These materials are usually masonry (brick, stone, concrete block, concrete and adobe) or water. Water storage is usually contained in only one wall of a space. The water wall is located in the space in such a way that direct sunlight strikes it for most of the day. Water storage walls are usually constructed of plastic or metal containers. During the daytime the water absorbs heat so that at night, when outdoor temperatures begin to drop, this heat is returned to the living space.

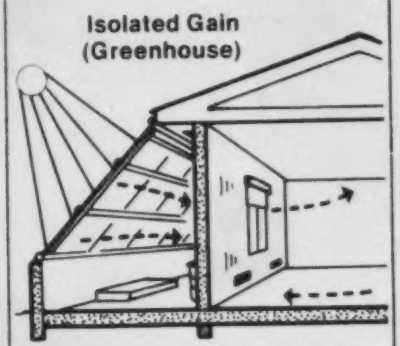
2. **Indirect Gain** — Another approach to passive solar heating is what experts call the indirect gain. In this method, sunlight first hits a thermal mass (thermal storage wall or roof pond) which is located between the sun and the space to be heated. The sunlight is absorbed by the mass and is converted to thermal energy (heat), and then transferred into the living space. A thermal storage wall absorbs heat on its outer surface and then

Direct Gain



Indirect Grain





transfers the heat through the wall by conduction. A water wall transfers this heat through the wall by convection rather than by conduction. In a roof pond system the thermal mass is often located on the roof of the house or building, where the water is enclosed in plastic bags, supported by the roof which usually also serves as the ceiling of the room below. In winter the ponds collect sunlight during the day and then are covered with insulating panels at night. The covering system, of course, is often electrically operated. In summer the panels are covered during the day to protect them from the sun and heat and removed at night to allow the ponds to be cooled by natural convection and by radiation to the cool night sky. Because of the special construction needed for the heavy weight, the roof pond system is limited in use.

3. **Isolated Gain** — In this system solar collection and thermal storage are isolated from the living spaces, function independently of the building, and heat is drawn from the system only when needed. An example of this system is one which includes a flat plate collector and heat storage tank. As water or air in a collector is heated by sunlight, it rises and enters the top of the storage tank, while simultaneously pulling cooler water or air from the bottom of the tank into the collector. Openings in the top and bottom of the wall separating the sun's face from the living area utilize a natural convection current. A very popular example of isolated gain is the sun space (greenhouse). When south-facing access to the sun is available, this system can easily be added to an existing home. The space itself acts as a collector. The flooring or other material used in the sun space acts as a storage medium for absorbing the sun's warmth.

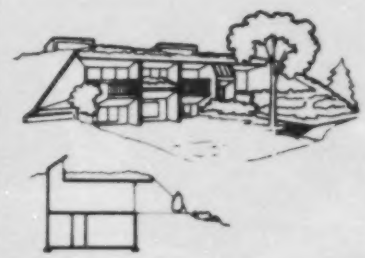
Because solar energy is so new to *today's* world, and because home designs and solar systems must have careful planning for successful systems, the solar home is not a project for a casual do-it-yourselfer. The successful solar system requires careful planning so as to gain the maximum amount of heat from the sun at any given time. One must consider the sun's angle to the earth and the specifics of construction. Many helpful books, articles and pamphlets have been published recently which offer advice and information to those interested in solar heating systems.

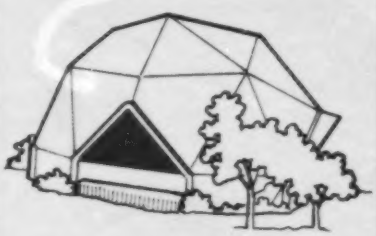
Earth Sheltered Housing

Another type of construction designed to conserve natural resources has commanded a high level of interest among energy experts and construction engineers. This is the earth-sheltered home, sometimes called an "underground" house.

Proponents of this type of home cite many advantages of this style over conventional home styles. Concrete, used extensively in this type of construction, is durable and long lasting; these houses require little exterior maintenance. They are a natural shelter from severe storms, and offer a natural buffer from pollution and environmental noise. They also require less energy for heating and cooling—a big factor considering today's rapidly rising energy costs.

Generally initial construction costs are higher than standard homes because of the weight the structure needs to support and





sometimes city codes make it difficult to construct earth-sheltered homes.

Earth, although a poor insulator, does have a good capacity to moderate temperature change. Several feet down the earth's temperature is approximately 55°F. (13° C.) year round. Earth-sheltered homes require some insulation and it is usually placed between the earth cover and the exterior of the structure.

Dampness and humidity control have been among the greatest problems in earth-sheltered housing. Excess moisture can damage insulation materials, complicate moisture draining systems and cause a "damp" feeling inside the home. Special precautions must be taken in the design and construction of an earth-sheltered home to control moisture. Methods and materials are now available to provide for effective waterproofing, foundation drainage and control of moisture build-up. As with solar systems, the earth-sheltered home is not something for the do-it-yourselfer to tackle. A well-planned, comfortable earth-sheltered home requires the skills of construction engineers who are familiar with building materials and the special techniques of earth-sheltered construction.

Some of the advantages achieved in an earth-sheltered home can be realized in an earth-bermed home. In an earth-bermed home, earth is simply heaped up on three sides of the home or the home is built into the hillside. Usually the maximum attic insulation is installed. Construction costs are less than in the earth-sheltered home because traditional construction techniques can be used.

Two other types of alternate housing—geodesic homes and double wall construction (home within a home)—are in various stages of development. These are some of the many ideas which are challenging the traditional home design. Alternate housing offers a new world of adventure and energy conservation. Some people see these as the "homes of the future"—and the future will tell if their prediction is correct.

3 Foods And Nutrition

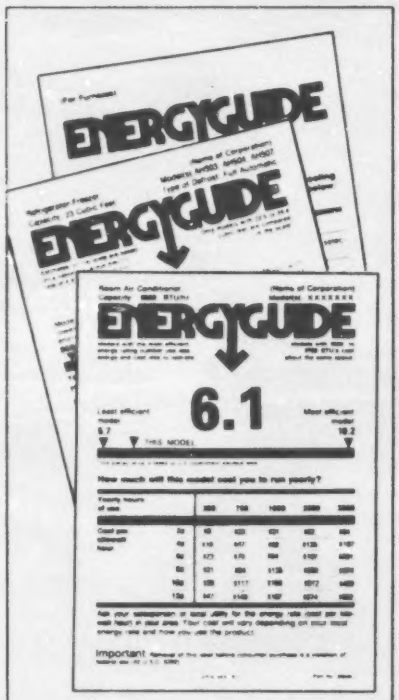
Introduction

When you consider that 19 per cent of the energy consumed in America is used in the home, then it is easy to see that the people living in each house have the opportunity to *conserve* a great deal of energy.

The home preparation and preservation of food accounts for nearly 13 per cent of the total home energy consumption. Most of the energy used in the home is for 1. *storage* (refrigeration and freezing) and 2. *preparation* (ranges, ovens and small appliances.) Food storage and preparation follow heating/cooling and hot water heating as the major home energy users.

In earlier units we have probed ways in which energy can be better managed in the area of Housing and Home Furnishings. In this unit, we'll take a look at large and small users of energy in the kitchen to discover ways to manage our energy resources. This area includes:

1. Appliance Labeling
2. Energy Management of Major Appliances
3. Your Refrigerator/Freezer and Energy
4. Microwave Ovens
5. Portable Kitchen Appliances
6. Energy and the Food Cycle



Lesson 1 — Appliance Labeling

Objectives: Upon completion of this lesson students will be able to identify the three different kinds of Energy Guide labels and explain their usefulness in the purchase of major appliances.

Background Information: Attached.

Activities: FN#2 and FN#3 Attached

FN#1 — Field trip to appliance store to study appliance labels (Jr, Sr, Adult)

FN#2 — Recovering higher purchase costs of the energy efficient model (Sr, Adult)

FN#3 — Determining the lifetime costs of appliances (Sr, Adult)

Resources: "Appliance Labeling" Fact Sheet, U.S. Department of Energy.

"Watch for the new appliance energy labels," Changing Times Magazine, March 1980.

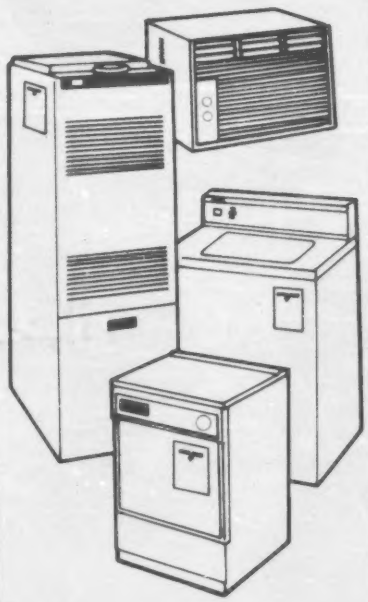
"Appliance Labeling Workshop" slide script, U.S. Department of Energy.

Suggestions: Invite a home economist or appliance dealer to present a demonstration on appliance labeling contact them for information.

Use the Appliance Labeling Resource Kit (actual labels with explanations of each, slide set and activities to duplicate). Available from Nebraska Energy Office.

Arrange a visit to a heating and cooling equipment dealer or utility company to study generic and EER labels.

Visuals: Fig. #9, 10 and 11. These are full-size samples of appliance labels located in the Resource section. These can be duplicated for classroom use.



Lesson 1 — Appliance Labeling

As energy costs increase, each step taken to decrease consumption of energy can be a money-saving step as well. Thus, the purchase of a major appliance can be an energy conservation decision.

It may cost *more to purchase* an energy efficient model of an appliance, but it may cost *less to operate* it. Most major appliances will last 10-20 years, so selecting an energy efficient model is a very important step toward sound energy management.

Since May, 1980, Energy Guide labels have been affixed to major appliances such as **furnaces, refrigerators, freezers, refrigerator/freezer combinations, water heaters, clothes washing machines, dishwashers** and **room air conditioners**. These appliances account for 73 per cent of all the energy consumed in American homes.

Central air conditioners and heat pumps will carry Energy Guide labels if standards are set. Energy Guide labels won't be issued for ranges and ovens, microwaves, television sets, clothes dryers, humidifiers, dehumidifiers or miscellaneous home heating equipment other than furnaces. Tests show energy usage among similar models of different brands of these appliances to be similar. Energy Guide labels have not been required on small appliances, such as toasters or blenders.

The appliance labeling program has been under the direction of the U.S. Department of Energy and the Federal Trade Commission. The appliance labeling program was part of the Energy Policy and Conservation Act of 1975 passed by Congress.

The bright yellow and black labels show the annual energy cost of operating a specific appliance. The cost figures are based on the national average electric rate of 4.97¢ per kilowatt hour — a rate within the range of Nebraska electric rates.

Generally, most energy efficient appliances cost more. This may be because better parts and/or more insulation or special features have increased the cost of production. However, considering the operating costs over the life of the appliance, it may be a better investment to purchase the more expensive — i.e. the more energy efficient model.

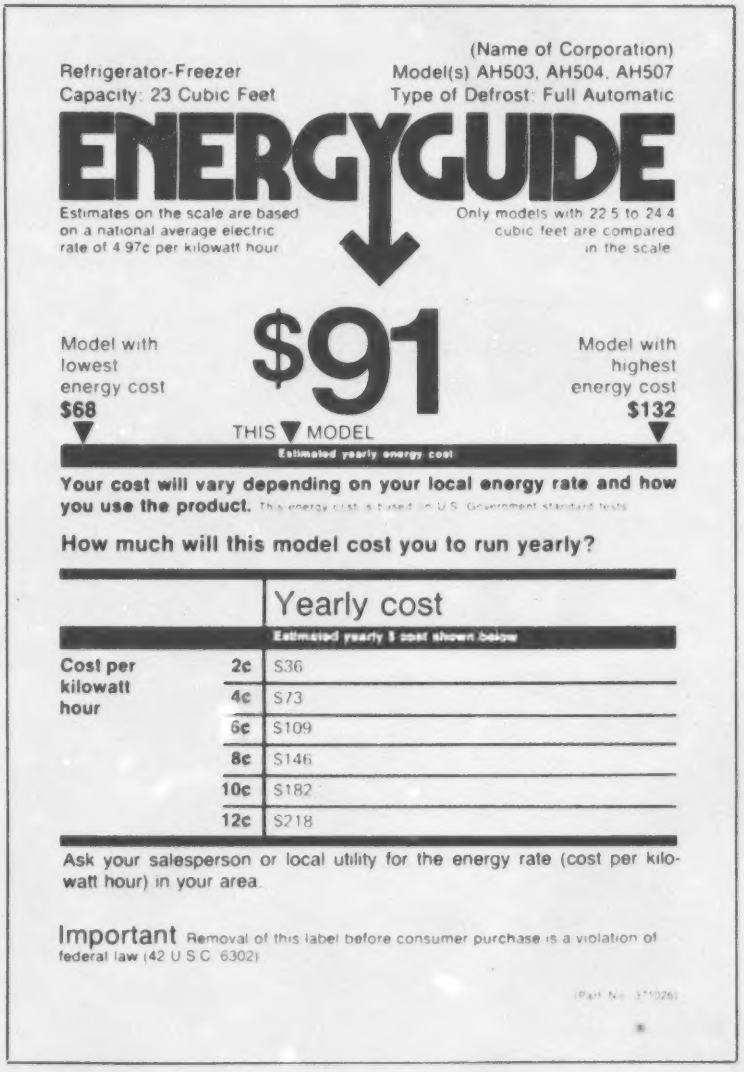
Basically there are three types of Energy Guide labels to be found on appliances: Energy Cost, Energy Efficiency Rating and Generic.

Energy Cost Label:

The Energy Cost labels compare the operating costs of competing brands and models of similar size and features. The large number in the center of the label is the annual estimated cost of the energy required to operate the appliance (based on the national average electricity rate). To the left and right below the figure is the range of operating costs of competing brands and models of similar size and features. With just one glance you can tell how this model compares with others. Below is a chart showing the yearly operating costs based on different electric

rates. If you know your local electric rate, you can figure your cost of operation.

The Energy Cost label is used on refrigerators and freezers and refrigerator/freezers, water heaters, dishwashers and clothes washers. The Energy Cost labels for dishwashers and clothes washers also include a chart indicating the cost of using the appliance with either a gas water heater or an electric water heater.



(Name of Corporation)
Refrigerator-Freezer
Model(s) AH503, AH504, AH507
Capacity: 23 Cubic Feet
Type of Defrost: Full Automatic

ENERGYGUIDE

Estimates on the scale are based on a national average electric rate of 4.97¢ per kilowatt hour

Only models with 22.5 to 24.4 cubic feet are compared in the scale

Model with lowest energy cost **$68**

$91

THIS ▼ MODEL

Model with highest energy cost **$132**

Estimated yearly energy cost

Your cost will vary depending on your local energy rate and how you use the product. This energy cost is based on U.S. Government standard tests

How much will this model cost you to run yearly?

		Yearly cost
		Estimated yearly $ cost shown below
Cost per kilowatt hour	**2¢**	$36
	4¢	$73
	6¢	$109
	8¢	$146
	10¢	$182
	12¢	$218

Ask your salesperson or local utility for the energy rate (cost per kilowatt hour) in your area.

Important Removal of this label before consumer purchase is a violation of federal law (42 U.S.C. 6302)

(Part No. 3710261)

Energy Efficiency Rating Labels: (EER)

This type of label is used for the room air conditioner which is a climate control appliance. The Energy Efficiency rating is printed in large numbers in the center of the label. The EER ratio is obtained by comparing the energy output (BTU's) of the

appliance to the energy input (watts). A *higher* number indicates a more efficient appliance.

To the left and right are EER ratings for other models with the same cooling capacity. The label also contains a cost per kilowatt hour chart based on expected hours of use.

Room Air Conditioner
Capacity: 9500 BTU/hr

(Name of Corporation)
Model(s) XXXXXXX

ENERGYGUIDE

Models with the most efficient energy rating number use less energy and cost less to operate.

Models with 9300 to 9799 BTU's cool about the same space.

Least efficient model **5.7**

6.1

Most efficient model **10.2**

THIS MODEL

Energy Efficiency Rating (EER)

This energy rating is based on U.S. Government standard tests.

How much will this model cost you to run yearly?

Yearly hours of use		250	750	1000	2000	3000
		Estimated yearly $ cost shown below				
Cost per kilowatt hour	2¢	$8	$23	$31	$62	$94
	4¢	$16	$47	$62	$125	$187
	6¢	$23	$70	$94	$187	$281
	8¢	$31	$94	$125	$250	$374
	10¢	$39	$117	$156	$312	$468
	12¢	$47	$140	$187	$374	$562

Ask your salesperson or local utility for the energy rate (cost per kilowatt hour) in your area. Your cost will vary depending on your local energy rate and how you use the product.

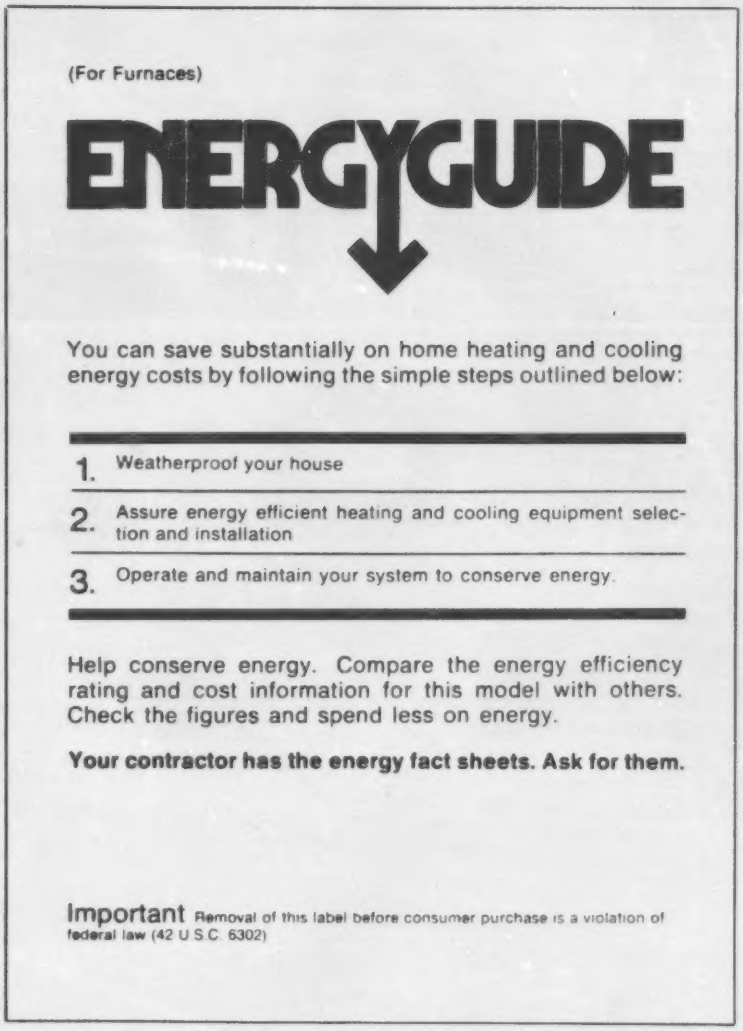
Important Removal of this label before consumer purchase is a violation of federal law (42 U.S.C. 6302)

(Part No. 20648)

Generic Labels:

The Generic label is required on all furnaces. It contains basic information on how to conserve energy in the home. It also draws attention to an energy fact sheet developed by the manufacturer which is available from the dealer. The fact sheet contains information on system components and overall efficiency on

different combinations. It also gives energy costs of the system for various geographic locations and utility rates.


(For Furnaces)

ENERGYGUIDE

You can save substantially on home heating and cooling energy costs by following the simple steps outlined below:

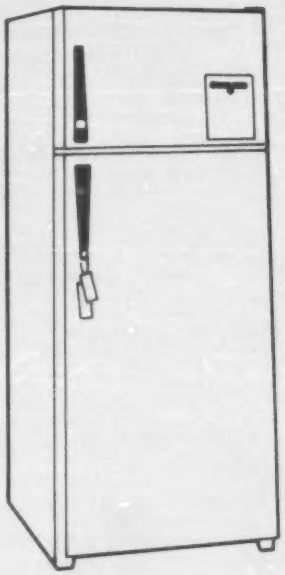
1. Weatherproof your house
2. Assure energy efficient heating and cooling equipment selection and installation
3. Operate and maintain your system to conserve energy.

Help conserve energy. Compare the energy efficiency rating and cost information for this model with others. Check the figures and spend less on energy.

Your contractor has the energy fact sheets. Ask for them.

Important Removal of this label before consumer purchase is a violation of federal law (42 U.S.C. 6302)

The selection of energy efficient appliances is only one step in the careful management of energy supplies. Once an energy efficient appliance is purchased it should be used energy efficiently. The U.S. Department of Energy estimates that if we would cut residential energy use by 20 per cent, the reduction would amount to more than a half billion barrels of oil each year. That's about 1/6 of our nation's oil imports.



FN#2
Recovering Higher Purchase Costs of the Energy Efficient Model

Generally speaking, the more energy efficient model—that is, the appliance with the lowest annual operating costs—will be the most expensive to buy. The less expensive model will usually cost more to operate. To figure which appliance is most economical compare the purchase price and operating costs using this formula:

1. Subtract the purchase price of the less expensive model from the price of the more expensive model.
2. Subtract the lower yearly operating cost from the higher yearly operating cost.
3. Divide the difference in initial purchase price by the difference in yearly operating costs.

The answer is the number of years for the lower operating cost of the more energy efficient model to offset its higher initial purchase price.

Now follow the steps using this example:

Appliance	**Model A**	**Model B**
Refrigerator/Freezer		
Purchase Price	$550	$450
Yearly Operating Cost	$38	$72

Solution:
1. $550 - $450 = $100
2. $72 - $38 = $34
3. $100 divided by $34 = 2.94 years

It will take 2.94 years for the lower operating cost of the more energy efficient model to offset its higher initial purchase price.

During a visit to an appliance store, obtain the purchase price and average annual operating cost from two models of appliances having the same capacity and similar features, but having different purchase prices and operating costs. You can do this exercise with appliances having the cost labels: refrigerators and refrigerator/freezers, freezers, clothes washers, dishwashers and water heaters. Compare as many different types of appliances as you can.

I.	Appliance: _____	Model: _____	Model: _____
	Purchase Price	_____	_____
	Yearly Operating Cost	_____	_____
	Years to offset higher purchase price	_____	
II.	Appliance: _____	Model: _____	Model: _____
	Purchase Price	_____	_____
	Yearly Operating Cost	_____	_____
	Years to offset higher purchase price	_____	

III. Appliance: _____ Model: _____ Model: _____
Purchase Price _____ _____
Yearly Operating Cost _____ _____
Years to offset higher purchase price _____

IV. Appliance: _____ Model: _____ Model: _____
Purchase Price _____ _____
Yearly Operating Cost _____ _____
Years to offset higher purchase price _____

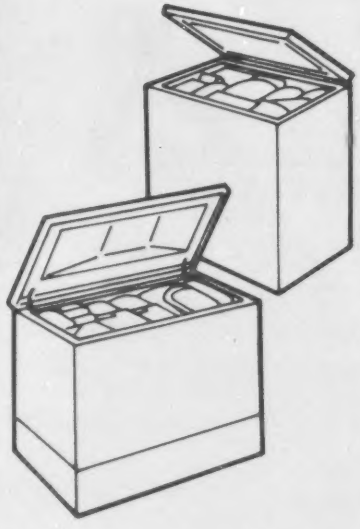
V. Appliance: _____ Model: _____ Model: _____
Purchase Price _____ _____
Yearly Operating Cost _____ _____
Years to offset higher purchase price _____

FN#3
Determining the Lifetime Costs of Appliances

Using the following life expectancy figures, calculate the lifetime costs of purchase and operation for appliances having the same capacity but with different purchase prices and operating costs.

Life expectancy, according to the U.S. Dept. of Energy:
Refrigerator — 15 years
Water heater — 11 years
Dishwasher — 11 years
Clothes washer — 11 years
Freezers — 19 years

Check as many kinds of major appliances as you can. Keep in mind that inflation will cause operating costs to increase annually, but for purposes of this exercise we will retain the same operating cost throughout the life of the appliance.



Formula: Purchase Price + (Operating Cost X Life Expectancy in years) = Total Lifetime Cost to *buy* and *operate*

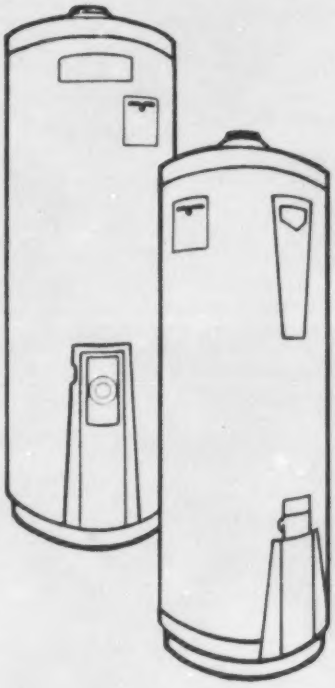
Example: Appliance Refrigerator (15 years life expectancy)	**Model A**	**Model B**
Purchase price	$550	$450
Yearly Operating Cost	$38	$72

Formula: Purchase Price + (Operating Cost X 15) = total lifetime cost to buy and operate

Model A. — $550 + (38 X 15) $570 = $1120 total lifetime cost

Model B. — $450 + (72 X 15) $1080 = $1530 total lifetime cost

Notice: Model A., although it costs considerably more to purchase, will cost less than the less expensive model over its expected lifetime.



Now use this formula to determine the total lifetime cost of several appliances.

		Model A.	Model B.
I.	Appliance: _____		
	Expected lifetime _____ years		
	Purchase Price	_____	_____
	Yearly Operating Cost	_____	_____
	Total Lifetime Cost	_____	_____
II.	Appliance: _____	Model A.	Model B.
	Expected lifetime _____ years		
	Purchase Price	_____	_____
	Yearly Operating Cost	_____	_____
	Total Lifetime Cost	_____	_____
III.	Appliance: _____	Model A.	Model B.
	Expected lifetime _____ years		
	Purchase Price	_____	_____
	Yearly Operating Cost	_____	_____
	Total Lifetime Cost	_____	_____
IV.	Appliance: _____	Model A.	Model B.
	Expected lifetime _____ years		
	Purchase Price	_____	_____
	Yearly Operating Cost	_____	_____
	Total Lifetime Cost	_____	_____
V.	Appliance: _____	Model A.	Model B.
	Expected lifetime _____ years		
	Purchase Price	_____	_____
	Yearly Operating Cost	_____	_____
	Total Lifetime Cost	_____	_____
VI.	Appliance: _____	Model A.	Model B.
	Expected lifetime _____ years		
	Purchase Price	_____	_____
	Yearly Operating Cost	_____	_____
	Total Lifetime Cost	_____	_____

Now discuss the results of your calculations. In each case which model would you purchase? Why?

Lesson 2 — Energy Management of Major Appliances

Objectives: Upon completion of this lesson students will be able to list energy management rules for the wise use of major home appliances.

Background Information: Attached.

Activities:

FN#4 — Visit an appliance store/dept., (or look at samples in catalogs), to look at different appliances and review the energy saving and energy wasting features of each model. (Jr, Sr, Adult)

FN#5 — Invite a "senior citizen" of the community to speak to the class about the 'old days' without refrigerators, ranges, etc., and tell some of his/her personal experiences. Or, if available, visit a museum which would have displays of earlier-day appliances. Or check the library for books showing pictures of these. (Jr, Sr, Adult)

Resources: "Energy in the Home . . . changing your habits," Cooperative Extension Service, Purdue University.

"Tips for Energy Savers," U.S. Department of Energy, 1977.

"Easy on Energy—with Appliances," University of Nebraska Cooperative Extension Service NebGuide, HEG78-95, 1978.

Suggestions: Ask students to interview grandparents, great-grandparents or elderly friends about the kitchens they grew up in. Ask about some differences in the kitchen 'then' and 'now.'

Ask students to design an appliance ad which incorporates energy information.

Ask students to make a check list of criteria for evaluating energy efficiency of major appliances. Share with parents, faculty and community members.

Ask students to make posters showing energy saving hints and tape them to the appliances in the Home Economics Department.

Lesson 2 — Energy Management of Major Appliances

We've learned the steps toward selecting an energy efficient model appliance whenever we buy a major appliance. But few people can afford to discard a major appliance which is an inefficient user of energy in order to buy one which is. So we must learn to use all appliances wisely—regardless of age and efficiency—in order to conserve energy.

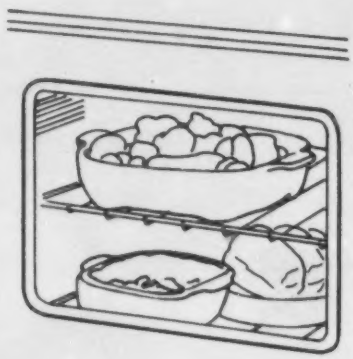
Keep in mind that nearly a fifth of the energy used in the United States is used in the home. As students of sound energy management we are able to influence how a great deal of energy is used—or misused. We *can* have a role in our country's energy future.

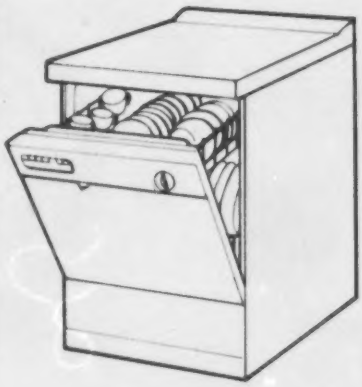
Many companies and organizations — appliance manufacturers, government agencies (at state and national levels) and utility companies, to name a few—have published booklets, brochures, pamphlets and books about home energy management techniques.

Following is a summary of energy-saving tips compiled from various sources.

Refrigerator/Freezers:

- Allow space between the condenser coils on the back or under side of the refrigerator and the wall. Keep the coils dust-free.
- Cut down on the number of times you open the door of the refrigerator.
- Place the refrigerator away from heat sources such as windows, heating ducts or the kitchen range.
- Defrost the refrigerator or freezer before frost is 1/4 inch thick.
- Don't keep the refrigerator or freezer too cold. The U.S. Department of Energy recommends keeping refrigerators at 38-40° for the fresh food compartment and 5° for the freezer compartment. Individual freezers should be kept at 0°.
- Make sure that the seals on doors are tight. On older refrigerators you can test the seals by closing the door over a piece of paper or a dollar bill. If you can pull the paper or bill out easily, the seal may need replacing or the door latch may need adjusting. On refrigerators with magnetic seals, this test will not work.
- Liquids and foods with considerable moisture should be covered and stored in the refrigerator. Moisture is pulled from uncovered liquids, making the refrigerator work harder.
- Arrange items in the refrigerator to allow for the easy circulation of air surrounding the items. Never cover refrigerator shelves with paper or foil. Shelf covering cuts down on circulation and prevents the appliance from operating efficiently.
- Never open the door and try to decide on a snack. Open the door as little as possible, and replace or remove several foods at one time.
- Frozen foods which require thawing can be thawed in the refrigerator, adding coolness to the refrigerator and reducing on cooking time of the food. Cool hot foods before putting in the refrigerator.





• The fuller the freezer, the less energy is required to keep foods frozen.

Ranges and Ovens:

• The oven does not need to be pre-heated to cook many foods. Don't preheat the oven unless you are baking foods containing baking powder, such as cakes, cookies or biscuits.
• When possible, use glass or ceramic baking dishes in the oven. These transfer heat more efficiently than metal ones.
• Don't peek in the oven! The oven temperature drops 25-30 degrees every time the oven door is opened.
• On electric ranges, turn the oven off for the last 5 minutes of baking most items. The retained oven heat will continue to bake the food.
• Cook several dishes at a time in the oven to use most of the heat (energy) that is being produced.
• If you are using a gas stove, make sure the pilot light and burners are burning efficiently—with a blue flame. If the flame is yellow, an adjustment is probably needed.
• Never boil water in an open pan. It is faster and takes less energy to heat water in a kettle or covered pan. And use a tight fitting lid to keep heat from escaping.
• Be sure the pan is flat on the bottom and that it fits the surface unit. The pan shouldn't extend more than one inch beyond the unit's trim ring.
• Keep range-top burners and reflectors clean. They reflect heat better.
• Use thermostatically-controlled surface units when available. They cycle on and off for better efficiency.
• Start cooking on high heat, then reduce to low. Always cook on the lowest possible setting, and turn the heat off before the end of the cooking period. The retained heat will last long enough to finish the cooking job.
• Cook vegetables in a minimum of liquid to conserve energy and vitamins—use only enough water to create steam and prevent sticking.

Dishwashers:

• The average dishwasher uses 14 gallons of hot water per load. Use the dishwasher efficiently. If every dishwasher user in the country cut out just one load a week, America would save almost 15 million kilowatt hours of electricity every day, or the equivalent of about 9,000 barrels of oil a day.
• Avoid using the "rinse hold" cycle on the dishwasher. This cycle uses 3-7 gallons of hot water.
• Turn off the control knob after the final rinse and let the dishes 'air dry' by propping the door open a little.
• If your model has one, clean the dishwasher filter often—waste build-up can reduce cleaning efficiency.
• Use the dishwasher in the morning or late evening when the electricity demands are lower.
• Wash partial loads only if you have a special setting for a short cycle. It is better to use the dishwasher only for full loads.

Washers and Dryers:

- Use the suds saver on a washing machine if you have one. Measure detergent carefully. Oversudsing makes the washing machine worker harder and use more energy.
- Whenever possible wash clothes in warm or cold water and rinse in cold water. Use hot water only when absolutely necessary (i.e. diapers, etc. . . .)
- Fill the washer whenever possible, but don't overload it. If the machine has a mini-load setting be sure to use it for small loads.
- A suds-soak cycle is handy when washing heavily soiled clothing. Pre-soaking may save two washings and therefore save energy.
- Clean the lint screen in the dryer after every load. Build-up of lint hinders the flow of air in the dryer and requires the machine to use more energy.
- Keep the outside exhaust vent of your clothes dryer clean. A clogged exhaust vent lengthens the drying time and increases energy use.
- If the dryer has an automatic dry cycle, use it. Overdrying merely wastes energy.
- Separate drying loads into heavy and lightweight items. Since the lighter ones take less drying time, the dryer doesn't have to be on as long for these loads. Dry loads consecutively to take advantage of heat stored in the dryer.
- Remove clothes that will need ironing from the dryer while they still are damp. There's no need to dry them thoroughly if they need to be dampened again for ironing.
- Use the clothesline whenever possible, and take advantage of *free* "solar" energy.

Lesson 3 — Your Refrigerator/Freezer and Energy

Objectives: Upon completion of this lesson students will be able to describe some of the factors which determine the differences in purchase cost, operating cost and energy efficiency.

Background Information: Attached.

Activities: Attached

FN#5 — Frost Free vs. Manual Defrost Refrigerators (Sr, Adult)

Resources: "Save Energy Save Dollars," Information Bulletin 125, Cornell University, 1977.

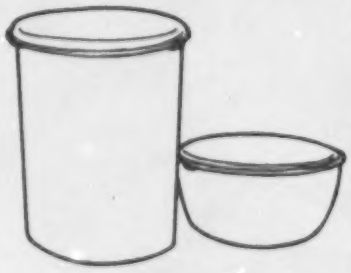
"Energy in the home . . . changing your habits," Cooperative Extension Service, Purdue University.

"Electrical Appliances and the Energy $," University of Nebraska Cooperative Extension Service, Home Economics NebGuide, HEG78-94, 1978.

Suggestions: Obtain copies of NebGuide (HEG78-94), "Electrical Appliances and the Energy $," so that students may do an electrical appliance audit and figure annual energy costs of various appliances.

Research how the refrigerator/freezer works; i.e. the physical changes of the refrigerant.

Examine a refrigerator that has a power-saver (power-miser) switch. Discuss the reasons for this switch.



Lesson 3 — Your Refrigerator/Freezer and Energy

It is easy to think of a refrigerator/freezer as an energy user because it runs off and on 24 hours a day, 7 days a week, 365 days a year. Refrigerators operate 25-50% of the time, depending on the model. The amount of food being stored also affects the amount of time the appliance operates.

However the refrigerator is also an energy saver because it protects the quality and safety of foods — food spoilage is a waste of natural resources and energy. And, proper storage allows you to keep enough food on hand so that it isn't necessary to go to the supermarket every day.

Side-by-side refrigerator/freezers usually require more electricity because they have the most freezer wall exposed. Frost-free two-door refrigerators also have a big energy appetite. Manual one-door refrigerators consume the least amount of energy, but must be defrosted. Frost build-up increases the amount of energy needed to keep the engine running. Frost should never be allowed to build up more than 1/4 inch. A build-up of more than 1/4 inch of frost is defeating the energy-conserving purpose of the manual defrost refrigerator.

A power-saver switch on a frost-free refrigerator is a helpful option. Tiny heaters in the door and walls prevent "sweating" on the outside when humidity is high. The power saver needs to be in operation (in humid position) only when the humidity is *very* high. Refrigerators use less energy when the humidity is low. In an air conditioned home the heaters are seldom needed.

Because a refrigerator is in use all the time, it is important to select the smallest size possible which fits the family's needs. Owning a separate freezer would also influence the size of the refrigerator needed. The recommended temperature setting is 40°F. for the fresh food compartment and 5°F. for the freezer section. (Separate freezers for long term storage should be set at 0°F.)

The refrigerator is an important and necessary appliance in every home, and should be selected and used with care. There are advantages and disadvantages to each type of refrigerator.

Frost-free or automatic defrost systems require little or no manual defrosting. They generally have cooler freezing compartments and keep an even temperature. However, because of the frost-free capability, food may have a tendency to dry out quickly unless tightly covered and requires more electricity.

The manual defrost model, on the other hand, probably uses less electricity, unless frost is allowed to build up, in which case it uses more. The freezer in this type of refrigerator usually does not freeze as cold as the frost free model, shortening the storage life of frozen foods.

Total #kWh Consumed
x Cost per kWh
Total Annual Consumption Costs

FN #6
Frost Free vs. Manual Defrost Refrigerators

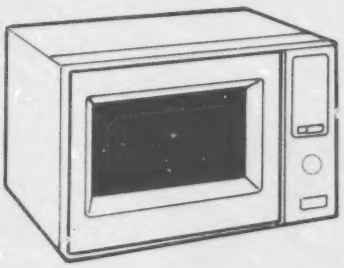
Using the formula provided, compute the annual energy consumption costs for the following models of refrigerator/freezers.

The average wattage listed for each appliance is the average of several similar appliances available on the market. The estimated annual kilowatt hour (kWh: unit to measure electricity used) consumption is based on national averages. This figure will vary for each geographical area of the United States, as well as for other factors.

Compute the energy consumption cost using the average cost per kWh of electricity from your local utility company, or use the national average of 4.97¢/kWh (1980 figure).

Formula: Total # kWh consumed X Cost per kWh = Total Annual Consumption Costs

		Average wattage	Est. KWH consumed annually
I.	Model A — frostless, 12 cu. ft.	321	1217
	Model B — manual defrost, 12 cu. ft.	241	728
	Total annual consumption costs: Model A _____ Model B _____		
II.	Model A — frostless, 14 cu. ft.	615	1829
	Model B — manual defrost, 14 cu. ft.	326	1137
	Total annual consumption costs: Model A _____ Model B _____		
III.	Model A — frostless, 15 cu. ft.	440	1761
	Model B — manual defrost, 15 cu. ft.	341	1195
	Total annual consumption costs: Model A _____ Model B _____		



Lesson 4 — Microwave Ovens

Objectives: Upon completion of this lesson students will be able to describe the capabilities and limitations of the microwave oven and explain the factors which influence cooking times of food prepared in a microwave oven.

Background Information: Attached.

Activities:

FN#7 — Various Capabilities of Microwave Ovens (Jr, Sr, Adult)
FN#8 — Conventional Oven vs. Microwave Oven (Sr, Adult)

Resources: "Microwaves" Fact Sheet, Minnegasco Co.

"We Want You to Know About Microwave Oven Radiation," U.S. Department of Health, Education and Welfare, Publication No. (FDA) 78-8058.

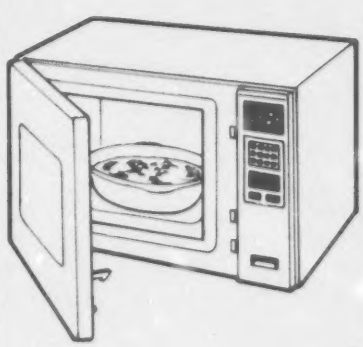
Pillsbury Kitchens' Family Cookbook, The Pillsbury Company, 1979.

"An Energy Education/Conservation Curriculum Guide for Home Economics Teachers," U.S. Department of Energy, 1977.

Suggestions: Invite a utility company Home Economist or Extension Agent to give a microwave oven demonstration to the class.

Visit a store selling microwaves to become familiar with the capabilities of different brands/models.

Demonstrate the misuse of the microwave oven by comparing the time it takes to boil a quart of water in the microwave as opposed to the top of the range.



Lesson 4 — Microwave Ovens

The microwave oven is rapidly becoming a standard item in the kitchen of American homes. It is estimated that about half of the households in America will be equipped with microwave ovens by the mid-1980's. About 20 per cent of the homes in Nebraska already have a microwave oven.

Microwave ovens are often touted as being energy efficient, but whether or not they save energy depends on how they are used. Before we study the energy-saving capabilities of the microwave oven it is important to understand how the microwave oven works.

When microwaves enter food they cause the liquid or moisture molecules in the food to vibrate at a fantastic rate. This vibration causes friction which produces heat throughout the food. This heat causes the cooking process. Microwaves first contact the outer surface of the food and the heat that is created is conducted toward the center of the food.

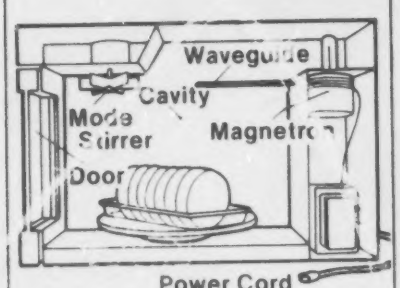
Remember that in a microwave oven the food is heated/cooled by the energy itself. The air in the oven and the dish in which the food is placed do not get hot. Microwaves pass through glass, ceramics, ovenproof dinnerware, paper products and some plastics. These items do not heat; the microwaves merely pass through them. One of the advantages of microwave cooking is that you can heat, cook and serve in the same dish.

Because microwaves affect the moisture molecules, the foods cooked in a microwave oven do not become brown or crisp as they do in the conventional oven or broiler.

Microwave ovens come in a wide variety of sizes and styles and with varying capabilities. A small, top-of-the-counter model which merely turns 'on' and 'off' is available, as are more sophisticated models which "memorize" recipes, tell time, have a 'thawing' cycle or variable speeds (such as high, medium and low power), and practically sings "good morning" to the cook. Manufacturers have also developed ovens which combine the convection and microwave ovens and the conventional and microwave ovens.

Many of the techniques of cooking with microwaves are similar to conventional cooking. But because of the increased speed when cooking with microwave energy, some special techniques are needed. Microwaves first contact the outer surface of the food, creating heat that is then conducted toward the center of the food. Because of this process of cooking from the outside to the inside the cook will need to learn some new cooking techniques. Because the outside edges of the food tend to cook first, especially on high settings, the first technique is that most foods should be turned during microwave cooking. This may mean turning over, stirring or rotating the food. Also, most foods should be allowed to stand approximately 1/4 of the cooking time before serving in order to allow for the heat to equalize throughout the food.

Speed was the original important advantage for microwave cooking, and is one of the biggest reasons for the microwave's popularity in the fast-paced life common to most American families. Energy efficiency has become a popular feature of the microwave as America's energy shortages have come to light



Generally the cook using a microwave oven is limited to non-metal cooking utensils. Metal cookware does not allow the microwaves to pass into the food. The use and care book which accompanies the microwave oven is the best source of information on cooking techniques and cookware.

Many variables affect the timing of recipes, and timing is the key to the successful use of the microwave oven. For instance, the *amount* of food is a big factor. Smaller quantities of food cook faster. As the amount of food increases, cooking time also increases. The *size* or *shape* of the food is another variable. Small pieces of food cook more quickly in a microwave than large pieces of food; thin pieces of food cook more quickly than thick pieces of food. Therefore, if possible, place the thickest pieces of food toward the outside of the container and thinner pieces toward the inside. *Food temperature* is another variable—refrigerated foods cook more slowly than warm or hot foods. If cold food is brought to room temperature before microwaving, the cooking process will require less energy. *Moist foods* cook faster than dry foods. How the food is *positioned* in the microwave affects its cooking time. Food should be distributed evenly. Round shaped baking dishes will do better than square or oblong shapes. Food placed in the corners of square or oblong dishes may receive more microwave energy, and overcook. The *denser* the food the longer the cooking time. Light, fluffy foods are cooked quickly because the microwaves penetrate easily.

If a microwave oven is to save energy, it must be used efficiently. If the microwave oven is used strictly as a substitute for poor planning and convenience, it will not save energy. It was not manufactured primarily for the purpose of thawing foods, although many owners use it consistently for that purpose. The key to efficient—and successful—microwave cooking is in the timing of the cooking process.

The microwave oven uses about the same amount of energy as a conventional surface unit at comparable settings. Cooking times determine energy efficiency. Generally speaking, *if food can be cooked in less time in a microwave than on a surface unit, the microwave oven is more energy efficient. As a general rule, if you have more than four items, the conventional oven would probably be more efficient.* The conventional oven is more efficient if filled to capacity. The microwave is more efficient for less food, such as one meat loaf, two baked potatoes or one pan of bar cookies. Though it is called an oven, the microwave oven is used most often to replace surface units in cooking. The microwave oven can accomplish good cooking results for 90% of all food preparation.

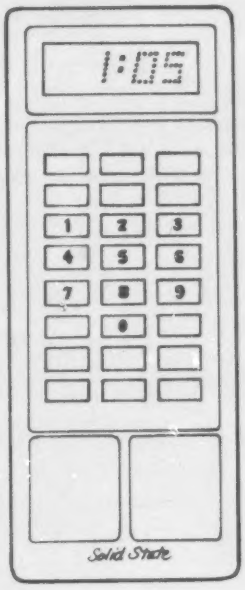
Because microwave and conventional ovens vary so much in energy consumption and structural efficiency it is difficult to make any general statements concerning the overall efficiency of both appliances. The microwave oven does heat only the food; the conventional oven heats the air within the oven, the container the food is in and the food. The microwave oven doesn't lose heat into the room and adds little moisture into the air during cooking.

The variables which determine time of cooking in a microwave will also help determine whether the microwave or another appliance—major or portable,—is more energy efficient in a

given situation. As with many other machines experimentation is the best teacher in learning to use a microwave oven correctly, and efficiently.

Also on the market is the "combination" range which contains the *conventional* and microwave oven. Both gas and electric ranges are available. Convection ovens with or without the microwave combination are also increasing in popularity. *Convection* ovens run on the principal of circulating air blown over the surface of the food, similar to the way a hot air furnace operates. Electronic technology has now developed an *induction* range top. This glass or ceramic top will heat in a fraction of the time present electric ranges take to heat. According to one report, these range tops will have the potential to save 40% of the power an electric range now uses. In this decade we will see more and more use of micro-processors tied to ranges and other kitchen appliances.

87



FN#7
Capabilities of Microwave Ovens

Individually or as a class visit stores which sell microwave ovens and check the capabilities of different models. Some ideas (options) are listed for you. You can also check with microwave owners to learn what features they feel are most useful.

Model	Wattage	Variable Power Options	Digital Timer	Continuous cleaning	Browning option	Clock	Large capacity	Recipe memory	Convection oven	Temperature probe	"Meal in One"	Automatic Turn Off	Thawing cycle	Cost	

FN#8
Conventional Oven vs. Microwave Oven

A microwave oven has the capability of saving energy as a result of the short cooking time needed for some foods. However, many foods can still be cooked more efficiently in a conventional oven.

Compare the energy required to cook the following food items: cake, tuna casserole, frozen TV dinner, frozen broccoli, and baked potatoes. To determine the energy used to cook each item, calculate the energy used in kilowatt hours (kWh). To do this you must first determine the wattage of the two appliances.

Microwave oven _____ watts (usually about 1450 watts)
Conventional oven _____ watts (usually about 3000 watts)

Then it will be necessary to determine the amount of time the unit *operates* to cook the food item. The operation time of the microwave oven will be easy to determine since it operates continuously and is usually equipped with a timer. The operation time of the conventional oven will be more difficult to determine since the pre-heat time, if used, must be included, and a conventional oven does not operate continuously. Use a stop watch to determine the exact time of operation. Time each interval that the baking element is operating (most ovens are equipped with a light which indicates when the oven is operating). Add these times to arrive at the total time of operation required to cook the food item.

Once the wattage and cooking times are determined, the energy use can be calculated. There are 1000 watts to a kilowatt and 60 minutes to an hour, making this formula for determining the kilowatt hours (kWh):

$$\frac{\text{Watts X Minutes}}{60{,}000} = \text{kWh}$$

For example, if a cup of squash requires 30 minutes to cook in a 3,000 watt oven, it requires 1.5 kilowatt hours of energy:

$$\frac{3{,}000 \times 30}{60{,}000} = 1.5 \text{ kWh}$$

Use the same recipe in each oven and test these results:

1. **Cake**
   - Conventional Oven _____ kWh
   - Microwave Oven _____ kWh
2. **Tuna Casserole**
   - Conventional Oven _____ kWh
   - Microwave Oven _____ kWh
3. **Frozen TV Dinner**
   - Conventional Oven _____ kWh
   - Microwave Oven _____ kWh
4. **Frozen Broccoli**
   - Conventional Oven _____ kWh
   - Microwave Oven _____ kWh
5. **Baked Potatoes**
   - Conventional Oven _____ kWh
   - Microwave Oven _____ kWh

A. Circle the cooking method for each food item which used the least amount of energy.
B. You may determine the cost of the electricity used by multiplying the kWh by 4.97¢ (national average rate) or obtain the rate from your own utility company.
C. You may want to use different foods to test. But remember that to compare accurately, the quantities and types of foods must be the same for both ovens in order to provide valid comparisons.
D. What would have been the effect on energy consumption if more than one food had been cooked in the oven at once?

(This activity adapted from "An Energy Education/Conservation Curriculum Guide," U.S. Department of Energy, 1977)

Lesson 5 — Portable Kitchen Appliances

Objectives: Upon completion of this lesson students will be able to describe some of the features available in portable appliances and their relationship to energy consumption.

Background Information: Attached. Also refer to Home Economics NebGuide (HEG 78-94), Cooperative Extension Service, University of Nebraska—Lincoln, 1978, entitled "Electrical Appliances and the Energy Dollar."

Activities: Attached
FN#9 — Portable Appliance Audit (Jr, Sr, Adult)
FN#10 — Cost Comparisons for Cooking in Portable Appliances (Sr, Adult)

Resources: "Farm Journal's Cook It Your Way," Farm Journal Publishers, Inc. 1979.
Home Economics NebGuide 78-94.
"Electrical Appliances and the Energy Dollar;"
"Portables for the '80's," published by Nebraska Public Power District.
"Guide to Portable Electric Appliances," Sunbeam Corporation, 1979.

Suggestions: Demonstrate some appliances uses which are not familiar to students, such as the wok used to steam or a coffeemaker used to make soup.

Visuals: Fig. #12 — Kitchen for Portable Appliance Audit.

Lesson 5 — Portable Kitchen Appliances

There are probably few people who wouldn't run out of fingers when counting the portable appliances in their home. Most people would count beyond ten even when counting only those found in the kitchen.

For many, portable electric appliances have become a part of every day living. For a long time the *convenience* of these portables was the major reason for their popularity. Now we know that appliances can be energy *conservers*. Appliances—especially those with thermostats—often perform more efficiently than the conventional oven or surface units. For instance, baking a small casserole in the portable toaster/oven uses only 1/3 the energy of a conventional oven.

However, it is important to remember that portable appliances will not conserve energy unless they are used often and correctly. A portable appliance bought on impulse which sits on a shelf is not conserving energy, but rather is wasting the energy it took to produce it.

Many portable appliances, such as the Slow Cooker, lose little or no heat to the surrounding air as the contents cook. This is a big advantage during Nebraska summers.

Portable appliances should be selected with care. The Sunbeam Corporation suggests consumers use the following criteria in selecting portable appliances:

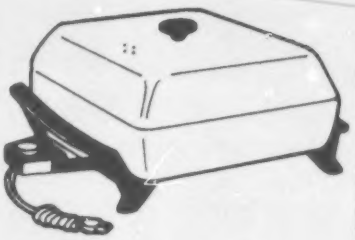
1. Buy from a reputable dealer.
2. Look for a warranty, plus availability of replacement parts and service.
3. Look for the Underwriter's Laboratory Seal of Approval on both the appliance and the electrical cord. This seal indicates that UL has tested and approved the appliance following prescribed standards for electrical safety.
4. Select sturdy, well-constructed appliances that are convenient in size and shape.
5. Select appliances that have conveniently located controls. The controls should be easy to read and operate.
6. Select appliances that are easy to clean, both inside and out. Look for parts and accessories that can be easily removed, cleaned and replaced.
7. Look for heat-resistant handles, controls and legs or table rests. These help to insure adequate protection against burns or marring of counter tops or table tops.

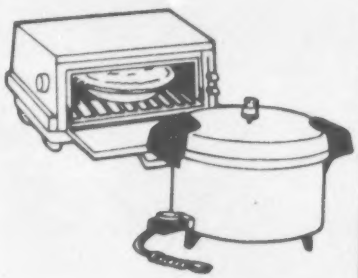
The Sunbeam Corporation also cautions the owner to use and care for the appliance properly to help assure maximum performance and longer service. The "use and care" book which accompanies an appliance is the best source of information for the proper use of the appliance and accessories.

Basically there are three kinds of appliances:

1. Heat producing—such as the toaster or electric fry pan
2. Motor driven—such as a mixer or blender
3. Heat producing and motor driven—such as a rotisserie

When selecting appliances, consider the wattage of the appliance and the capacity of your electrical outlets so that circuits are not overloaded when using more than one appliance at a time. Overloaded circuits are not only inefficient, they can become hazardous due to overheating or circuit breakdown.





Nearly seven out of 10 homes in the United States today own an electric fry pan. The electric fry pan is, perhaps, one of the most versatile and efficient appliances. In it one can fry, grill, simmer, braise, stew, roast, bake, steam, boil, blanche, warm, cook casseroles and even make popcorn! Some fry pans have a ceramic crock insert, and can be used as a slow cooker.

Slow cookers are also versatile appliances. In them one can make roasts, soups, stews, puddings or hot beverages, as a few examples. Some have baking pans and racks for roasting. Although most foods cooked in the slow cooker will cook for several hours, the wattage is low.

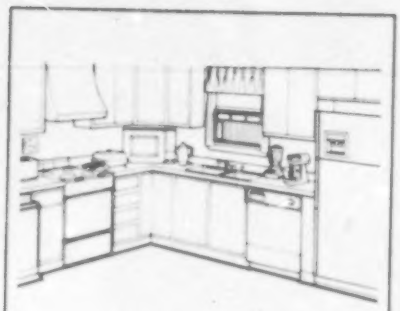
The toaster oven is usually interchangeable with a conventional oven except that it is smaller. If what you are baking is small enough to fit into the toaster oven, you can save about 2/3 of the energy it would take to bake the same item in the conventional oven.

Cooking with a pressure cooker means speed—a popular feature of this appliance. The pressure cooker is often associated only with less tender cuts of meats, but can, like other appliances, cook a whole meal in one.

The electric wok is associated with oriental dishes, but needn't be limited to them. Many dishes can be prepared with the stir-fry method. With the stir-frying method foods are cooked on high heat, use a small amount of cooking oil and require little cooking time. It also preserves the nutritive value of foods. The wok may also be used for steaming, braising, stewing or deep fat frying.

The drip coffeemaker brews coffee more efficiently than it can be "perked" on the range. The coffeemaker can also heat water for tea or for reconstituting soups, cereals, bouillon, hot chocolate and other foods.

Whatever the portable appliance, remember to select it carefully and use it with energy management in mind.



FN#9
(Fig. #12)
Portable Appliance Audit

Most American homes are filled with large and small appliances, from electric toothbrushes to hot dog cookers. Many of these appliances are ones used in the kitchen to prepare and serve food. Conduct an appliance audit in your own kitchen. List the appliances you have found. Be sure to look in all the doors and cupboards! Refer to the list of portable appliances (Fig.#12) located in the resource section.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.

Now after each appliance write the approximate number of times the appliance is used in your home every week.

FN#10
Cost Comparisons for Cooking in Portable Appliances

Determine the cost of cooking the same food product in as many different appliances as possible. Decide on a menu, such as a 3 lb. pot roast with potatoes, carrots and onions, or a stew containing beef chunks, carrots, potatoes and celery. Whatever you choose to cook, *use the same recipe and amounts* in each appliance, and adapt the cooking method to the appliance.

To determine the "on" time of thermostatically controlled appliances, use these figures provided by the Association of Home Appliance Manufactuers:

Fry pan (approximately 1200 watts) — "on" 62% of cooking time

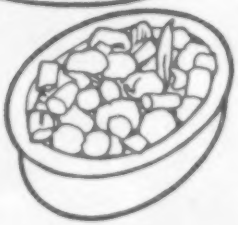
Slow cooker (approximately 200 watts) — "on" 100% of cooking time

Toaster/oven (approximately 1500 watts) — "on" 26% of baking time

For the following appliances, exact "on" times are not available. Use a stop watch, or assume, for purposes of this activity, that the "on" time is about 55%.

Wok (approximately 1000 watts)
Conventional Oven (approximately 3,000 watts)
6" surface unit on high setting (approximately 1400 watts)
8" surface unit on high setting (approximately 2,600 watts)
Roaster (approximately 1,333 watts)

The microwave oven (approximately 1450 watts) is "on" for 100% of the cooking time at high power.



The formula for figuring the kWh (kilowatt hours) of electricity used is:

$$\frac{\text{Watts X (minutes X \% ``on'' time)}}{60{,}000} = \text{kWh}$$

For example, if a roast cooks for 3 hours in an electric fry pan:

$$\frac{1200 \text{ X } (180 \text{ X } .62)}{60{,}000} = 2.23 \text{ kWh}$$

Now you can calculate the cost by this formula:
kWh X rate = cost
4.97¢/kWh is the national average. Use your local rate if possible.
2.23 X 4.97 = 11¢ cost for roast cooked in fry pan

For the appliances you have used, enter the total kWh used, and then figure the cost using either 4.97¢ (national average) or your local utility rate.

1.	Fry pan:	____ kWh	____ Cost
2.	Slow Cooker	____ kWh	____ Cost
3.	Wok	____ kWh	____ Cost
4.	Toaster/Oven	____ kWh	____ Cost
5.	Conventional Oven	____ kWh	____ Cost
6.	Surface Unit	____ kWh	____ Cost
7.	Roaster	____ kWh	____ Cost
8.	Microwave	____ kWh	____ Cost

Now rank the appliances from most to least economical. Discuss your results. Keep in mind that this is not a 'scientific' study due to some variables which are hard to control in a classroom or home situation. This activity will provide you with cost comparisons for real dollar savings in the kitchen.

Lesson 6 — Energy and the Food Cycle

Objectives: Upon completion of this lesson students will be able to explain some of the steps in the food chain, and discuss methods for saving energy within that chain.

Background Information: Attached.

Activities: (Attached)

FN#11 — Energy and the Food Cycle

Resources: "Energy Education/Conservation Curriculum Guide for Home Economics Teachers," U.S. Department of Energy, 1977.

"By Bread Alone," by Lester R. Brown, Praeger Publishers, 1974.

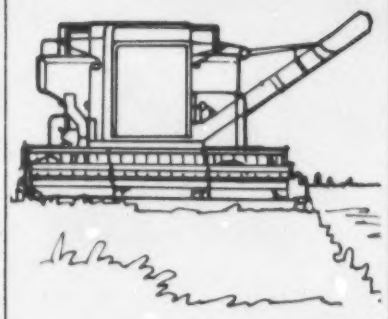
"Energy, Food, and You," Washington State Office of Public Instruction.

Suggestions: Visit a recycling center for any recyclable product.

Make a bulletin board "Energy and the Food Cycle" and show the food chain for a popular item such as pizza or a hamburger.

As a class, organize a presentation on recycling and wasted energy to present to other classes.

Ask the industrial arts class to make a solar food dryer and then experiment with several kinds of food.



Lesson 6 — Energy and the Food Cycle

Today thanks to the huge equipment (driven by fossil fuels) available to farmers and the wide array of chemical fertilizers and pesticides (usually produced and applied with fossil fuels), we are able to produce enough food for our entire population and export vast amounts of food to other countries. Yet, less than 5 percent of our population is directly employed in agriculture.

As a "modern" nation we have accomplished this task by gradually easing away from human labor and draft animals in favor of sophisticated machines and equipment. However, in the process we have become an energy-intensive society. The amount of energy used to produce food relative to the energy it contains is rising steadily.

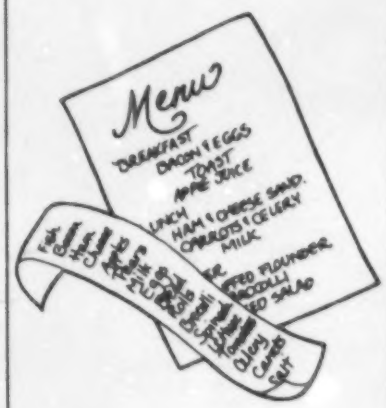
The energy content of food produced by farmers in 1910 was slightly greater than the energy used to grow, process and transport the food. Ten years later the system was using half again as much energy as its products contained. By 1970 nearly 9 calories were being consumed by the system for every calorie contained in the food produced. By the time this food reaches the consumer's plate the total energy expended is many times that contained in the food.

While the on-farm production of food is certainly energy-intensive, it is the food processing, transportation and distribution systems that consume the most energy.

We can blame part of this energy consumption on the sophisticated levels at which we *preserve*, *package* and *store* food. The world's oldest method of food preservation—drying—uses little energy if the sun is the source of the energy. However, we have developed dryers powered by fossil fuels to remove moisture from farm products. Canning uses energy to preserve food products, but little if any additional energy is needed to store the canned products until consumption. Freezing, which is an effective method of preserving food with quality and freshness, is energy-intensive in the freezing process, and requires a continuous supply of energy for the frozen food. Fresh foods, of course, eliminate the cost for preservation. In addition, the distances between farmer and consumer have increased as our population has become urbanized, making the use of more energy necessary in the transportation of food.

A major source of energy waste is in the *packaging* of foods. Often more energy has gone into making the container than in the food itself. We could eliminate some of this waste by using fewer disposable containers and by purchasing more food in bulk. The most energy-intensive containers are throw-away metal cans, plastic bottles, packaged ready-to-heat snacks or meals and aerosol cans. Twice as much energy is required to produce a 6-oz. spray can of cooking oil as an equal amount of bottled cooking oil.

By re-using containers, we could save a great deal of energy. The Environmental Protection Agency has estimated that if 90% of the market used returnable beverage containers, 92,000 equivalent barrels of oil could be saved each day. Returnable bottles save a lot of energy, with only a slight inconvenience to the consumer. It takes 7836 Btu's to produce a 16 oz. returnable



bottle which can be used 10-15 times. It takes 6002 Btu's to produce a 16 oz. non-returnable bottle which can be used just once. **(Btu. — British Thermal Unit —** is a unit of heat equal to 252 calories; it is the amount of heat needed to raise the temperature of one pound of water one degree Farenheit. A Btu. is approximately equivalent to the amount of heat given off by burning one wooden safety match.)

Americans are making more of an effort to recycle aluminum cans, but the effort is really only a "drop in the bucket" when compared to what could be done.

For example, the production of one pound of white potatoes (excluding packaging) requires:

6250 Btu's — fresh
9000 Btu's — canned
14950 Btu's — frozen
26700 Btu's — dehydrated

The figures speak for themselves.

Another inefficiency in the food system is the *transportation* of food from the supermarket to home. It is inefficient to use the family car—a two-ton vehicle—to transport several pounds of food several miles once or twice a week. It makes better energy sense to plan carefully, shop less often, car pool or combine shopping with regular commuting trips. And riding a bicycle or walking uses even less energy!

All around us in our daily routines energy is being used—and wasted. But it doesn't have to be that way! Every effort to *manage* that energy efficiently and to put it to better use is a step in the right direction.

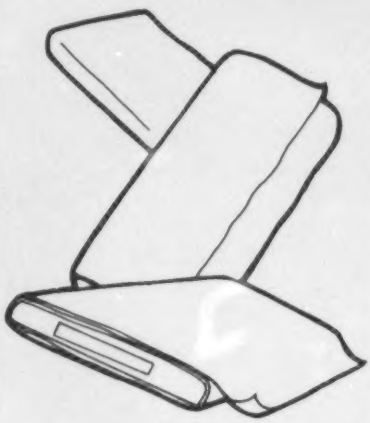
FN#11
Energy and the Food Cycle

Twelve steps in a food system are listed below for a frozen vegetable. Which steps could be eliminated to save energy?

1. Farmer grows and harvest the vegetable
2. Transports it to a processing plant
3. It is sliced by the machine
4. It is packaged
5. It is frozen
6. Refrigerator-truck takes it to market
7. Market keeps it frozen
8. Drive to market and buy it
9. Take home and put in freezer
10. Thaw it and cook it
11. Throw away package
12. Eat it

Now construct the food chain steps for a canned soft drink or hamburger, and then make suggestions for steps which might be eliminated to save energy.

(This activity adapted from the "Energy Education/Conservation Curriculum Guide for Home Economics Teachers," U.S. Department of Energy, 1977.)



4 Clothing And Textiles

Introduction

With the steadily increasing emphasis on energy conservation and management all sectors of the economy are examining their energy use patterns. The textile industry is no exception.

In 1980 the textile industry reported a leveling off of fiber, textile and apparel production. That may be because people are placing more emphasis on the thermal comfort of clothing to meet their individual needs, and less emphasis on the desire to have a closet full of new clothes each year.

The textile industry—fabrics, apparel and home furnishings—accounts for a relatively low percentage of our energy usage. Approximately three percent of the available crude oil is used in the production of man-made fibers, synthetic rubber and plastics. However, when you consider that 50 percent of the *world* consumption of fibers is in man-made fibers, then the role of energy in textiles is considerable.

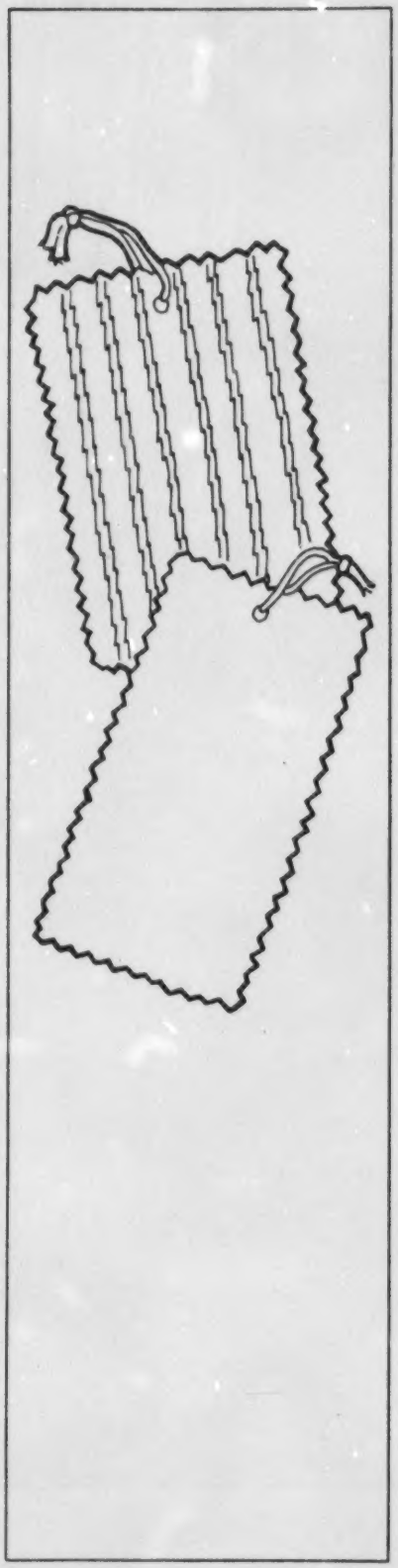
Natural fibers—cotton, wool, linen and silk—accounted for only 25 per cent of the fibers used in the United States in 1979. The man-made fibers accounted for only 10 per cent in 1940; 75 per cent in 1979. Some people have suggested a return to natural fibers as a means of reducing energy consumption. However, that would be impractical because we do not have the land for growing the cotton and grazing the sheep that would be necessary to return to an all-natural fiber industry.

The National Science Foundation financed a study to determine energy requirements of cotton versus polyester. The study concluded that it takes 25 per cent more energy to produce a polyester/cotton shirt than it takes to produce a 100 per cent cotton shirt. But it also discovered that the life cycle energy requirements for the 100 per cent cotton shirt are 90% greater than the blend. Garments made of 100 per cent cotton require more drying and ironing.

The textile industry predicts that polyester/cotton blends will remain the single most important fabric in textile products, and that the industry is committed to perfecting blends of natural and man-made (synthetic) fibers which give the best balance of price and performance.

In this unit we will discuss...

1. Basics of Thermal Comfort
2. Energy Efficient Wardrobe Planning (Fashion vs. Fad)
3. Energy Management in the Sewing Center
4. Energy Efficient Care of Clothing
5. Recycling



Lesson 1 — Basics of Thermal Comfort

Objectives: Upon completion of this lesson students will be able to describe ways in which heat is lost from the body and how clothing affects comfort.

Background Information: Attached.

Activities:

CT#1 — Field trip to a department store to view ready-made clothing and/or fabric. Judge clothing (and fabric) by its "thermal comfort" and suitability for the season. In judging, consider the characteristics of clothing which affect thermal comfort.

CT#2 — Make a bulletin board showing characteristics of clothing which affect thermal comfort: textile fibers, fiber absorbency, color, design, fit and cleanliness. Show good examples and poor examples of these characteristics. Make it a "warm weather" or "cold weather" bulletin board.

Resources: Nebraska Farm, Ranch and Home Quarterly, Vol. 23, No. 3, 1976.

"Saving Energy With What You Wear," North Central Regional Extension Publication 73, University of Illinois at Urbana-Champaign, 1979.

"Cut Cooling Costs: Keep Cool With Clothing," Circular HE-35-1, Cooperative Extension Service, North Dakota State University, 1978.

"Be Aware of What You Wear," Home Economics NebGuide HEG 77-87, University of Nebraska-Lincoln, 1977.

Suggestions: Make a bulletin board showing the ways heat is lost.

Use hang tag samples from ready-made clothing to discuss finishes and varying properties of the fiber blend, considering their "thermal" qualities.

Lesson 1 — Basics of Thermal Comfort

Summer days in Nebraska can mean hot temperatures and high humidity. Winter days can mean bone-chilling temperatures and strong winds. How do we stay comfortable when we have been urged by government, energy specialists and by our pocketbooks to turn the thermostat down to 65-68° F. in winter and up during the summer to 78° F.? While making those thermostat adjustments we must also do other things to achieve thermal comfort—to help the body keep itself at a constant temperature despite the influences of the environment.

Each person differs in his and her ability to tolerate very cool or very warm temperatures. Many people feel their health is at stake and that they cannot afford to risk colds, flu or pneumonia by turning the thermostat down in winter. However, health professionals say that anyone who is in generally good health has a good resistance to winter illnesses as well as a good tolerance for lower temperatures indoors. Infants can tolerate 60-70 degree temperatures if they are kept warmly clothed and the relative humidity is high. These specialists advise that elderly people should consult their physicians before lowering the thermostat drastically.

Processes of Heat Loss

Several factors affect our desire to increase or decrease the artificial heat around us. The normal body temperature of 98.6°F. is maintained by body processes, activity and metabolism (burning of food). When the body is very active more heat is produced, making it necessary to "lose" heat in order to maintain this temperature.

The body loses heat through conduction, convection, radiation and evaporation.

1) Heat is lost through **Conduction** — when a cold object or surface comes in direct contact with the body. If you sit on or lean against a cold surface some heat is transferred from your body to the surface.

2) Heat is lost through **Convection** — when warmth leaves the body and is transferred to the cooler air around the body. An example of convection loss is the movement of warmth from a skier as the skier travels downhill.

3) Heat is lost by **Radiation** — the transfer of heat by electromagnetic waves from the body. Clothing on the skin interrupts this flow of heat from the body.

4) Heat is also lost by **Evaporation**. As you breathe and sweat, warm moisture leaves the body. As sweat evaporates it cools, providing the body with an efficient "automatic cooling system."

Radiation, convection and conduction are usually significant only when the environmental temperature is much lower than the skin temperature. Evaporation is the primary method of heat loss when the environmental temperature is higher, as on hot summer days.

When a body is warmer than the air surrounding it, heat flows away from the body. If too much heat is lost, the person becomes chilled and uncomfortable and begins to shiver. Clothing influences this loss of body heat.

Characteristics of Clothing... Fibers and Fabrics

Several factors determine how well clothing allows heat to escape or how much insulation it provides. Let's consider these:

Air is a relatively poor conductor of heat but a good insulator. Tightly woven or tightly knit fabrics hold air and moisture in. These fabrics will be more comfortable if made from absorbent fibers, otherwise they may cause a sticky, clammy feeling. For cold weather, when warmth is the goal, fabrics from loosely twisted yarns are thick and absorbent. The thicker the fabric, the warmer it will be, because there will be more dead air space among the fibers to provide insulation. Thick does not mean heavy. Some fabrics can be thick but still be lightweight. Fabrics such as velveteen, corduroy, furs and fake furs, quilted fabrics and thermal knits are examples of good insulators.

Textile fibers vary widely in their ability to **insulate.** Many man-made fibers, such as polyesters, are generally poorer insulators than are natural fibers, so a thin polyester fabric may make a poor winter blouse. Wool is a good insulator, even when wet.

Fabric combinations such as those in raincoats, ski jackets and pants also provide thermal comfort. These are vinyls, taffeta, some polyester blends or nylon which are quilted with a layer of polyester batting or down filling. These fabric combinations provide warmth by keeping cold air out and holding warm air near the body. In summer when breathability is important, fabric should be porous and lightweight with open, airy construction.

Fiber **absorbency** varies from fiber to fiber. The natural fibers—cotton, linen, silk and wool—and man-made rayon are usually considered to be the most absorbent.

Most of the man-made fibers are usually not considered absorbent, although some finishes have been developed to increase the absorbency of these man-mades. Absorbency is reduced by finishes such as durable press and water or oil-repellent finishes because they tend to hold perspiration close to the body. Absorbency is an especially important factor to consider in summer clothing.

Color affects us in two ways. Dark shades of any color absorb radiant heat from the sun while light colors and white reflect the sun's rays. Therefore, dark-colored fabrics are warmer when worn in sunlight than are light-colored fabrics.

Color also has a psychological effect upon our feelings of warmth or coolness. For example, colors such as red, yellow and orange are associated with fire and sunlight, while blue, green and violet are associated with cooler objects, such as water, sky and trees.

Design and fit also contribute to thermal comfort. Clothing does a better job of holding in body heat if it fits closely, especially at the neck, wrists and ankles. Long, fitted sleeves, turtlenecks, fitted waistlines and straight-legged trousers are good examples of clothing suitable for winter wear.

Close fitting does not mean "tight." Tight clothing inhibits circulation, and therefore hinders the body's ability to keep warm. It is important especially in winter, that blood circulation not be hindered by tight clothing. When the torso is warm, blood carries the warmth to the hands and feet. Some of the opposite

considerations hold true for summertime temperatures, when loose fitting styles are more appropriate.

It is also important to have **clean** clothing. Dirt will obstruct the open spaces in fabrics and decrease absorbency, breathability and insulation value.

We have considered the ways in which heat is lost from the body and factors affecting thermal qualities of clothing. Now, let's take a look at the variables affecting thermal comfort.

1) **Activities** — The more active a person, the more heat the body produces. The large muscles of the arms and legs generate most of the body heat.

2) **Temperature of the air** — Temperatures may vary considerably in a house or building. Also, it may be several degrees cooler on the floor than where you're sitting or standing because heat rises.

3) **Drafts** — In winter avoid drafts if possible, because the faster air moves, the greater its cooling effect. In summer this cooling effect is desirable.

4) **Radiant temperature** — Work where the sun's rays will warm you; take advantage of that "free" heat in winter.

5) **Humidity** — The amount of moisture in the air affects how quickly perspiration cools the skin. With high humidity a cool temperature will feel cooler, a higher temperature hotter. But enough humidity, especially in winter, is important for good health.

6) **Clothing** — Make a wise selection based on the thermal qualities of garments.

You can also influence the thermal comfort of your body. If *you* are physically fit and active you can adjust better to temperature changes. Dress for the activity you are doing. If you are sewing or reading, you will need to dress more warmly in winter; if you are cleaning or making beds, you can function with a little less clothing. Alternate the very active and less active events of your day. Exercising for 10-15 minutes will produce more body heat. Eating chocolate or other foods high in carboydrates will also speed up metabolism and increase body heat.

Keeping Warm

You can achieve thermal comfort by thinking of clothing, especially in winter, in terms of layers.

1) **Breathing layer** — This is the layer nearest the skin; it is especially important for evaporative heat transfer. The breathing layer allows excess body heat to escape by picking up body moisture from the skin and aiding in its evaporation. A t-shirt might provide the breathing layer.

2) **Insulating layer** — This layer holds warm air around the body in air spaces. For additional warmth, add more layers of fabric to achieve greater insulation. A sweater or shirt could serve as an insulating layer.

3) **Protective layer** — This layer keeps cold, moist or drafty air from penetrating through the layers and forcing out warmed air from the body. It is wise to have the outer layer (protective layer) be windproof and water-repellent.

When temperatures are very low, thermal balance is extremely important. A severe lowering of body temperature, called

hypothermia, can result if heat loss exceeds heat production. Very often just dressing properly could prevent hypothermia and frostbite. Flesh which is exposed to cold air can freeze surprisingly quickly, especially if the wind chill temperature (a temperature based on air temperature and wind speed) drops below -25° F.

It is also important to cover the head because it loses heat quickly. We know that a century ago people even wore head coverings at night.

"Mamma in her kerchief and I in my cap had just settled down for a long winter's nap."

Some experts say that as much as 90 per cent of the body heat is lost through the head because body heat finds uncovered areas from which to escape. A head covering that is tightly woven and made from wool or cotton provides good insulation. Hands need to be covered too. Mittens are generally warmer than gloves because they aren't tight, and the fingers are together for greater warmth.

Leotards, pantyhose, opaque hose and thick socks help protect the feet and legs. Shoes and boots with thick soles, linings and heels keep the feet from close contact with the snow, ice and cold ground.

A study done by the U.S. Army shows that adding or replacing clothing can make vast differences in our thermal comfort. According to the study a woman can lower the thermostat setting 1.5° F. if she replaces a skirt with slacks. The study also shows that:

If a woman:	**She can lower the thermostat setting:**
Replaces a skirt with slacks	1.5°F
Replaces a sleeveless dress with a long-sleeved dress	.2°F
Replaces a dress made of an open weave with a tightly woven fabric	.5°F
Wears nylon stockings	.1°F
Wears a full slip	1.0°F
Replaces a half slip with a full slip	.6°F
Replaces a sandal-type shoe with a heavier shoe	.2°F
Pulls on a light, long-sleeved sweater	1.7°F
Pulls on a heavy, long-sleeved sweater	3.7°F

If a man:	**He can lower the thermostat setting:**
Replaces light pants with heavy pants	.6°F
Replaces a summer-weight jacket with a winter-weight jacket	2.5°F
Replaces a short-sleeved shirt with a long-sleeved shirt	.8°F
Puts on a winter-weight jacket	4.5°F
Puts on an undershirt (T shirt)	.5°F
Puts on a tie	.2°F
Replaces ankle-length socks with knee-length socks	.6°F
Puts on a light, long-sleeved sweater	2.0°F
Puts on a heavy, long-sleeved sweater	3.7°F

(Study by Dr. Ralph Goldman, U.S. Army Ergonomics Laboratory and the John B. Pierce Foundation, New Haven, Connecticut)

Keeping Cool

Thus far most of our emphasis has been on keeping warm in the winter so that we can be comfortable with lower thermostat settings. But we mustn't overlook the costs of cooling during Nebraska summers when temperatures inch their way to the top of the thermometer. The greatest electricity demands are in summer, and because utilities must increase their supplies the rates usually increase.

Just as we can dress to keep warm, we can also dress to keep cool. And by dressing intelligently we can decrease our need for air conditioning.

If a woman wears a light skirt instead of slacks, a sleeveless top instead of a long-sleeved blouse, and sandals instead of closed shoes, she can raise the thermostat a couple of degrees without feeling warmer.

The U.S. Office of Energy Conservation and Environment states that raising thermostat settings in all air conditioned homes and businesses in the United States by only one degree would save the U.S. the equivalent of 100,000 barrels of oil a day. By dressing sensibly a person can raise the thermostat by one degree and remain comfortable.

The same factors which affect the thermal quality of winter clothing apply to summer clothing—fibers, fabrics, absorbency, color, design, fit and cleanliness.

When the weather is hot, we perspire. When this perspiration evaporates in the air, the body becomes cooler. For thermal comfort in the summer, it is important to select clothes which will allow air to flow across the skin. That's why loose garments with large neck and sleeve openings will feel cooler than clothing which fits closely at the sleeves, neck and waist. Clothing that clings will insulate the body. Openings at the neck, arms and legs will allow body heat to escape.

Avoid wearing accessories such as belts or scarves in summer because they block air movement. Wear single layers of clothing and open shoes. A wide-brimmed straw hat will shade you from the direct sun.

Experts suggest water-repellent rather than water-proof rainwear. A water-proof coat won't let out heat and moisture to allow the skin to "breathe".

Absorbent fibers hold moisture from the body. An absorbent fiber will carry moisture away from the skin and aid in cooling by evaporation. Cotton is usually considered the most absorbent fiber. Linen and lightweight wools are also absorbent and therefore can keep the body cool. Manufacturers have developed absorbency finishes which can be applied to man-made fabrics.

Just as color helps in winter weather, it offers help in summer too. Dark colors absorb sunlight. Light colors, which reflect sunlight away from the body, are cooler. Cool colors such as blue and green give the psychological effect of coolness.

The U.S. Army has also published guidelines for adjusting clothing to stay cool. This study shows how the amount of clothing we wear has a significant effect on our summer comfort.

Women	Raise Thermostat Setting
Replace light slacks with light skirt	1.5°F
Replace long-sleeved dress with sleeveless dress	.2°F
Replace dress made of tightly woven cloth with one having an open weave	.5°F
Remove stockings	.1°F
Replace full slip with half slip	.6°F
Remove full slip	1.0°F
Replace pumps with sandals	.2°F
Remove hat	.2°F
Remove light long-sleeved sweater	1.7°F
Remove heavy long-sleeved sweater	3.7°F

Men	Raise Thermostat Setting
Replace heavy trousers with light trousers	.6°F
Replace winter-weight jacket with summer jacket	2.5°F
Replace long-sleeved shirt with short-sleeved shirt	.8°F
Replace long light trousers with Bermuda shorts	1.0°F
Remove summer-weight jacket	2.0°F
Remove undershirt (T-shirt)	.5°F
Remove tie and open collar	.2°F
Replace knee-length socks with ankle socks	.6°F
Remove light long-sleeved sweater	2.0°F
Remove heavy long-sleeved sweater	3.7°F

(Study by Dr. Ralph Goldman, U.S. Army Ergonomics Laboratory and the John B. Pierce Foundation, New Haven, Connecticut)

It is clear from our study of thermal comfort that the clothes we wear can help us avoid adjusting the thermostat.

Lesson 2 — Energy Efficient Wardrobe Planning

Objectives: Upon completion of this lesson students will be able to list the steps involved in examining and evaluating a wardrobe for function, versatility and practicality.

Background Information: Attached.

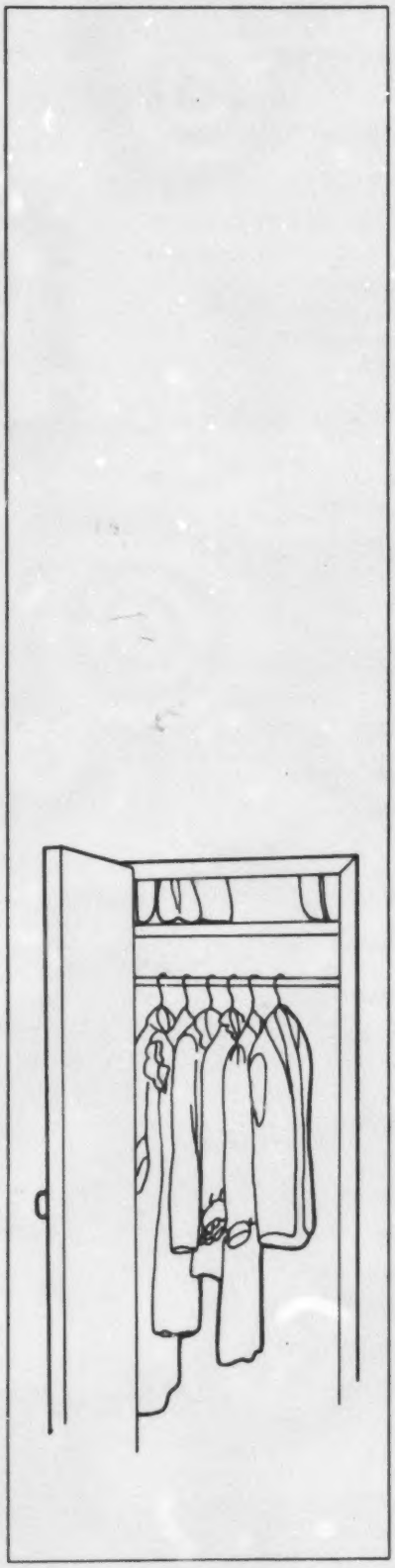
Activities:

CT#3 — Wardrobe Audit. Audit your wardrobe and make recommendations for improving its versatility.

Resources: "Functional Fashions for You," Home Economics NebGuide HEG 79-109, Cooperative Extension Service, University of Nebraska-Lincoln, 1979.

Cho, Emily and Linda Grover, *Looking Terrific*, G.P. Putnam's Sons, New York, 1978.

Suggestions: Make a bulletin board entitled 'Fashion vs. Fad' showing "fads" and classic styles. Use magazines and pattern books for clippings.



Lesson 2 — Energy Efficient Wardrobe Planning

Our nation's history shows that when economic stress faces us we tend to re-examine our basic needs—food, clothing and shelter. This History shows that of the three needs, clothing is the one which is "first to go" because people "make do" with last year's fashions.

Our country is facing more than just periodic economic stresses; we are also faced with long-term energy limitations. Because so many of our easy-care fabrics are petroleum based, each garment purchase or each yard of fabric we buy has an impact, however minute, on our energy future.

This is why it is important to plan wardrobes carefully, giving thought to fashion on a long term basis instead of buying each season's "fad". A well planned wardrobe is one which provides comfort, utility, and attractiveness for the wearer.

Proper clothing selection is a very big factor in energy management. Wearing a blazer, slacks and blouses may be fashionable, but when the temperature is 100° F it is not very good energy management. Dressing for fashion and adjusting the thermostat up or down became a habit during the days of cheap oil.

Step 1

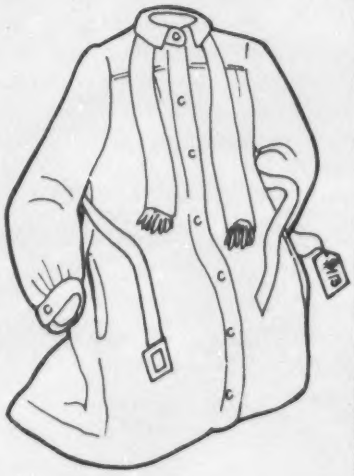
Creating a versatile, functional wardrobe requires planning. It begins with questions such as: What are your needs? What is your lifestyle? What kinds of activities do you enjoy? What *types* of clothing do you need? What are the current fashion trends? (Keep in mind that you want a functional wardrobe which reflects lasting classic trends.) How much money can you spend? Before you can develop a well-managed wardrobe or extend the one you have, you must answer these questions.

Step 2

Now you're ready for the next step—auditing your wardrobe. Examine your clothing for one season. Take everything for that season out of the closet, try it on, and group it. *Try on everything!* Afterwards you might divide the clothing into groups of "ready to go," "out of style," "needs repair," "needs cleaning," and even a pile of "doesn't fit."

Consider the clothes you've placed in the "out of style" section. Are they garments which are just not wearable? Are they too short; too long? Can anything be done to "recycle" them into wearable garments? If not, get them out of the closet and dispose of them—they're taking up valuable closet space.

Next consider the "doesn't fit" group. Is there anything which can be done to make these garments fit? Weight gain or loss is a common reason clothes don't fit. If any of the garments can be altered to serve a purpose in the wardrobe, then put them in an "alteration" pile. If they cannot be altered to make them usable, then dispose of them with the "out of style" group of clothing.



Step 3

Now evaluate what is in your wardrobe, including those garments destined for the dry cleaners or laundry. Try different skirts with different jackets or blouses; you might discover some new combinations to extend your wardrobe.

Spread your accessories out too. Accessories can make an outfit look completely different. What accessories do you have which could alter a different outfit to advantage? How do the accessories fit into your wardrobe? If there are accessories which don't fit your wardrobe get them out of your closet or chest of drawers.

For a winter wardrobe accessories could also be used to add warmth. A wool scarf worn with a winter coat, for instance, adds warmth at the neck. And a scarf tied at the neck of a sweater, blouse or jacket adds warmth.

Step 4

Once you have thoroughly evaluated your present wardrobe you are ready to consider additions. Your addition might be another skirt to go with some blouses, or a jacket to go with some skirts and slacks.

Avoid layered ensembles during summer. Layers make it more difficult for body heat and moisture to escape. In winter, layering helps trap body heat.

Separates—mix and match articles of clothing—provide a lot of wardrobe versatility. Coordinating separates well takes a little skill, but they are a good investment because they can stretch across the seasons.

There are many ways to add to your wardrobe. The most obvious is to buy the additions. Or if you can sew, you might like the personal satisfaction of making the additions yourself. Today, garage sales and second hand shops are frequented by people of all economic levels, and are a good place to find high quality clothing at prices any pocketbook will appreciate.

Step 5

The last step in planning a well-managed wardrobe is replacing items as they wear out or become unwearable. Replace these items—many of them major purchases—with function foremost in your mind. If it is time to replace a winter coat, for instance, a style with a button-up neck is probably more functional than a wrap-around style, especially in Nebraska winters.

Audit your wardrobe every season, to keep it versatile, functional and up-to-date. Energy management is teaching us to return to the basics—a basic, versatile wardrobe which provides thermal comfort.

Lesson 3 — Energy Management in the Sewing Center

Objectives: Upon completion of this lesson students will be able to describe how sewing tasks can be accomplished without wasting energy.

Background Information: Attached.

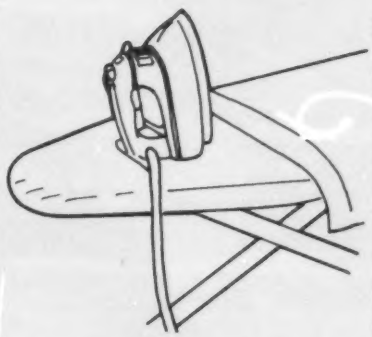
Activities:

CT#4 — Energy Savings While Sewing in the Classroom. Demonstrate energy-saving methods while sewing and ironing or pressing. (Jr, Sr, Adult)

CT#5 — Energy Savings While Sewing at Home. Attached (Jr, Sr, Adult)

Resources: "Saving Energy With Clothing and Textiles," Coats & Clark, Inc. Stamford, CT., 1979.

Suggestions: In coordination with a unit in Housing and Home Furnishings, design a sewing/laundry room which uses available light as much as possible.



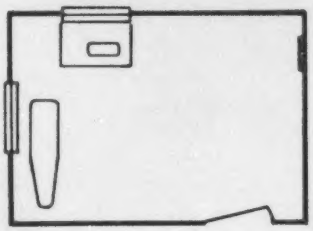
Lesson 3 — Energy Management in the Sewing Center

Because sewing machines use little energy—usually less than 100 watts per hour—it may seem that sewing is not an activity where much energy can be conserved. But sewing involves other energy-using products, too—the iron, lights and special steamer devices. The combination of these energy-using devices is an important area in which to practice good energy management.

Like every machine the sewing machine needs care. The "use and care" book which accompanies the machine is the best guide to proper care and maintenance. Every machine operates more efficiently if it is maintained. Most experts would recommend a good cleaning and lubrication after every 8-10 hours of operation. Check your own sewing machine book for guidance.

Good lighting is essential while sewing. The best light is natural light. Fluorescent lights are also efficient. Especially in warmer weather, position the sewing machine near a window and take advantage of available light. This will cut down considerably on the use of artificial light and also allow you to take advantage of natural ventilation. In winter it would be more comfortable to move the sewing machine away from windows, where drafts are more likely to make you feel cooler. Always remember to turn off the sewing machine light when the light is not in use.

The iron is a big electricity consumer—often using 1000 watts or more per hour. For convenience the sewer often keeps the iron "on" all the time while sewing so that pressing steps can be completed as soon as the sewing is completed. Since the iron uses at least 10 times as much electricity as the sewing machine, it is wasteful to keep it heated when not in use. Perhaps it will be possible to complete several sewing steps, and then use the iron to press those steps. Organize your sewing and plan the steps in order to use the iron for several things at once. Then turn it off while continuing the sewing process. Similarly, steamers can be used on several garments or fabrics and then be turned off.



CT#5
Energy Savings in the Home Sewing Center

Draw a floor plan of the area where you usually sew. Draw the sewing table, iron, windows, artificial light sources and heat sources. Now re-draw the arrangement showing how you can take advantage of available natural light by moving the sewing table or ironing board.

Lesson 4 — Energy Efficient Care of Clothing

Objectives: Upon completion of this lesson students will be able to describe methods of managing energy in the laundry room.

Background Information: Attached.

Activities:

CT#6 — Demonstrate the effects of cold, warm and hot water on powdered detergents. See how long it takes the powder to dissolve in each temperature of water. Also demonstrate "spot" cleaning on garments before putting them in the wash.

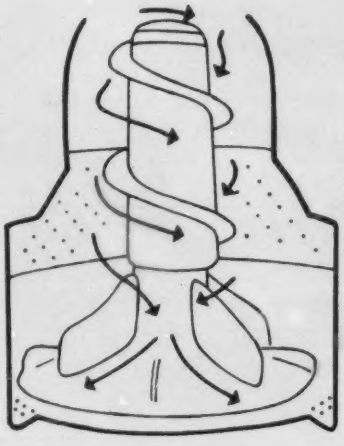
CT#7 — Survey of capabilities of washers and dryers (Attached)

Resources: "Laundry Techniques to Save Energy," Energy Conservation Fact Sheet, Cooperative Extension Service, University of Florida.

"A Short Course in Home Laundering," Consumer Affairs Department, Speed Queen Company, 1980.

"For Better Laundry Results," Home Economics Department, The Maytag Company.

Suggestions: Refer to "Efficiency Through Hot Water Usage," Lesson #8 in the Housing and Home Furnishings Unit, and "Energy Management of Major Appliances, Lesson #2, in the Foods and Nutrition Unit.



Lesson 4 — Energy Efficient Care of Clothing

Clothing care requires energy for heating water, washing and drying. As much as 95 per cent of the energy is used to heat the water and the other 5 per cent or so for the agitating, tumbling and spinning actions of the machine. Because of the heat required for drying, a clothes dryer can cost 15-35¢ an hour to operate, depending on electricity costs.

Before we can begin saving energy in the laundry, we must consider fabric composition, water temperature, hardness of the water, the washing machine, amount of soil and the operator.

A typical washing machine uses about 35 gallons of water for a complete washing job, depending on the water level, size of load and the washer capacity. Water enters the washer twice—for the wash cycle and again at the rinse cycle.*

If the setting is for "hot," all water comes from the hot water pipes; "cold" setting from cold pipes and the "warm" setting is usually about a half-and-half mixture of hot and cold. One company has listed water costs this way, using an electric hot water heater with electricity rates at 5¢/kWh:

Wash/Rinse Setting	Hot Water Cost/Load
Hot/warm	25¢
Hot/cold	17¢
Warm/warm	17¢
Warm/cold	8¢

These figures are only a guide but they show that much more energy is used for hot washes. After looking at these figures, it would be easy to say that we should do all our laundry with warm wash/cold rinse or even cold wash/cold rinse. But in some cases there are special considerations.

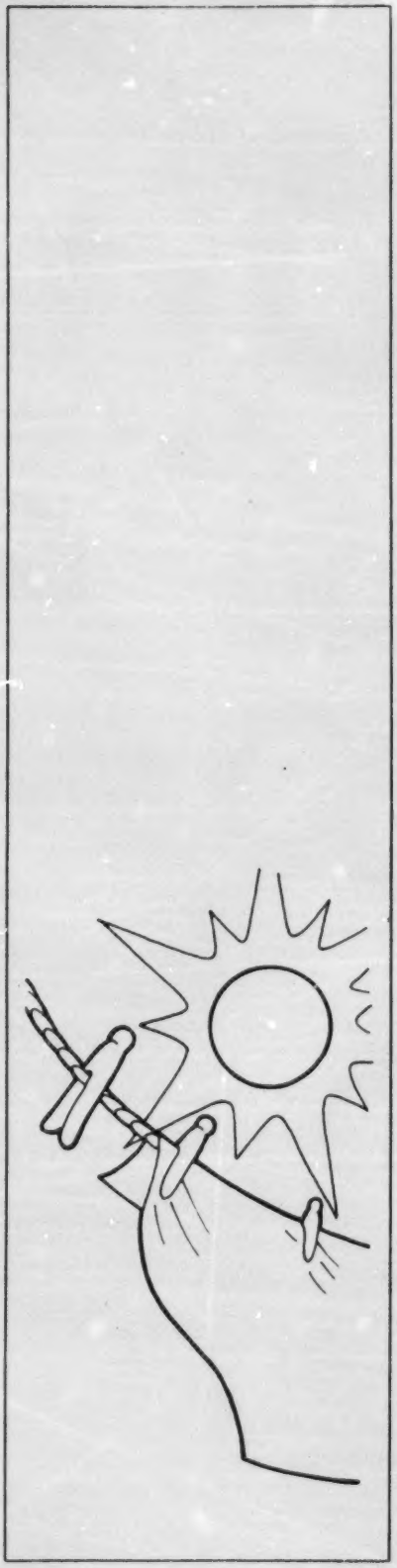
Experts caution that the colder the wash water, the more difficult it is to get clothes clean. This is especially true of heavily soiled clothing. Most manufacturers of soap and detergent products recommend that heavily soiled clothes be allowed to *soak* in a pre-wash or pre-soak cycle to loosen the dirt. Many manufacturers and clothing specialists also suggest that dissolving powdered detergents in warm or hot water before adding them to the wash water will produce better results even when using products designed for cold water. Another method would be to add the dissolved detergent to the cold water and agitate it a few seconds before adding the clothing since powdered detergents often do not dissolve well in cold water.

You can partially compensate for not using hot water by *lengthening the wash cycle*. You can do this by using the longest wash cycle or adding agitation time. For the best removal of heavy soil, clothing should be agitated at least 12 minutes.

It is also helpful to carefully *pre-treat* spots, stains and heavily soiled areas with special pre-treating solvents.

When reducing the water temperature the amount of detergent should be increased. As a general rule, some experts suggest

*Adjust the water levels, if the machine has one, to fit the size of the load, and try to wash only when you have a full load.



using 1 1/2 times the usual amount of detergent. Of course this will vary according to the type of detergent, load size, amount of soil and even the hardness of the water.

Soft water generally means cleaner washes regardless of water temperature. But is especially helpful when the wash is on the cold cycle. If you live in a hard water area (85 out of every 100 homes have hard water) a water softener is a help.

We must also consider the "care" label which is attached to each garment or printed on the end of a bolt of fabric. The manufacturers' recommendations are based on tests using different cleaning methods. **For best results these care suggestions should be followed.**

It is also important to consider the temperature of the water as it comes into the house. You can use a thermometer to test the temperature of the water at the faucet closest to the point of entry. Nebraska averages a ground water temperature of 55° F. Water at 50° F or below is generally too cold to give satisfactory laundry results.

Alternating cold, warm or hot washes can save energy and give good laundry results. If clothes get a dingy look, a wash in hot water with plenty of detergent will help restore brightness. This, however, is not recommended for delicate fabrics.

It is also important to *carefully sort clothes.* Sort according to color, fabric type and amount of soil. Permanent press fabrics and some knits attract lint and should be washed with clothes that do not produce lint. Don't wash lightly soiled with heavily soiled clothes—they may become dingy.

There are times when hot water washes are necessary. Water must be at least 140° F to disinfect clothes. Disinfection is necessary when there has been a serious illness in the family or when clothes have come in contact with pesticides or other chemicals. Hot water is also recommended for washing diapers.

There are no hard and fast rules to follow in washing clothes and attempting to save costly hot water. However we've listed some guidelines which will help. The person in charge of care is an important variable in the process of caring for clothing. What are your standards for clean laundry? You are the best judge of what is going to be most satisfying for you.

Clothes Drying

Conserving energy while drying clothes is a little easier—providing Mother Nature cooperates with good weather for *"solar"* drying! With solar drying the only costs involved are the initial installation of the clothesline and personal energy. A great deal of energy can be saved by simply drying the wash outdoors.

Locate a clothesline so that clothes will catch the wind which must be relatively free of dirt and dust. Try not to hang too many layers together; single layers will dry faster. If the wind is very strong it is advisable to hang heavy clothes over lightweight clothes to keep the wind from whipping the clothing.

You can still achieve good "wash and wear" results from hanging clothes outside on the line. *Shake* out the wrinkles before hanging the clothes on the line and hang flat pieces of laundry straight to reduce ironing. When hung properly, most items do not need to be fluffed in the automatic dryer and will need little or no ironing.

Sometimes weather or other considerations make it necessary to use the clothes dryer. Conserve energy by drying several loads in succession. Once the metal drum inside the dryer warms up it does not need to be heated again.

Be sure to select the proper drying setting as recommended by the manufacturer. Most dryers have a setting for permanent press fabrics which does not use as much heat as the setting you would use for cottons.

All appliances operate most efficiently if used and cared for properly. The dryer lint screen should be cleaned often. Try to dry only full loads, being careful not to overload the machine. **The biggest waste of energy in the laundry room is overdrying clothes.** Wash and wear clothes can be hung on hangars while still slightly damp. Separate clothes into light and heavyweights, taking advantage of the shorter drying time for lightweights.

Energy costs are a growing concern for all of us, but with common sense and energy management in mind, considerable energy can be saved in the laundry center.

117

CT#7
Survey of Capabilities of Washers and Dryers

Examine the washer and dryer in your own home and check the capabilities of each. Put a **second** check beside those capabilities which contribute to good energy management.

Washer:

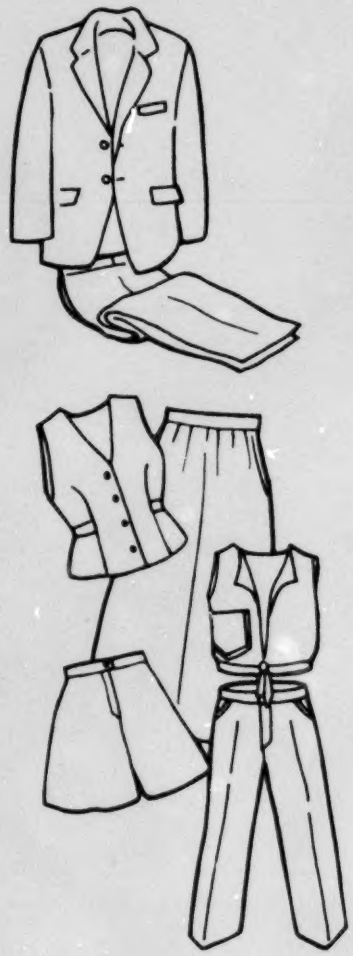
		1. Varying water levels
		2. Pre-soak cycle
		3. Permanent press cycle
		4. Regular wash cycle (10-15 minutes)
		5. Delicate cycle
		6. Varying water temperatures
		Hot/hot
		Hot/warm
		Hot/cold
		Warm/warm
		Warm/cold
		Cold/warm
		Cold/cold
		7. Extra large capacity
		8. Automatic bleach dispenser
		9. Automatic fabric softener dispenser
		10. Mini-basket
		11.
		12.
		13.
		14.

Dryer:

		1. Time control (set by minutes)
		2. Temperature and/or Fabric Control
		3. Anti-wrinkle feature (dryer tumbles without heat after drying is done)
		4. Moisture-sensing control (dryer "senses" when clothes are dry)
		5. "Knits" setting
		6. Delicate setting
		7.
		8.
		9.
		10.
		11.
		12.

Discuss your findings in class.

From a Man's Suit Make These ...



Lesson 5 — Recycling Clothing

Objectives: Upon completion of this lesson students will be able to list some advantages of recycling clothing and also some points to consider before beginning a clothing recycling project.

Background Information: Attached.

Activities:

CT#8 — Demonstrate how to take apart and prepare an old garment for laying out a new pattern. Demonstrate several simple alterations to make a garment stylish.

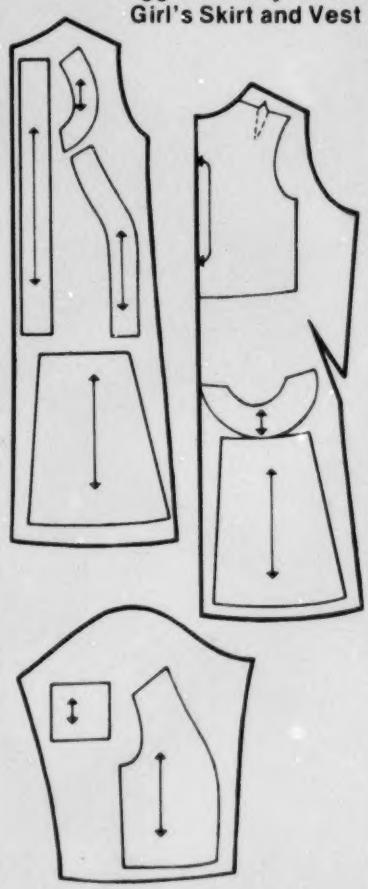
CT#9 — Recycling Project. Depending on the skill level of the students, assign a recycling project.

Resources: "Restyling Sweater Knits," E.C. 71-478, Cooperative Extension Service, University of Nebraska-Lincoln, 1971.

"Restyling or Remodeling a Garment," HEG# 77-60, Cooperative Extension Service, University of Nebraska-Lincoln, Revised 1978.

Suggestions: Collect samples of "recycled" clothing projects, both simple and extensive for a classroom display. Assemble items which could be "recycled" in class and discuss how they could be changed to be wearable.

From Old to New



Suggested Layout for Girl's Skirt and Vest

Lesson 5 — Recycling

"Recycling" has entered our vocabulary in recent years as our country has become more conscious of conserving energy and natural resources. Usually we think of recycling in terms of newspapers, phone books, aluminum or tin cans and glass jars.

But there's also another practical way to "recycle"—with clothing! Many of us have had the experience of receiving "hand-me-down" clothing. What is really happening in that time-honored tradition is recycling!

Recycling—restyling or remodeling a garment to make it wearable for self or someone else—has lots of advantages. Not the least of these is the economic benefit. We have already noted that in times of economic stress, the basic need which is generally the "first to go" is that of purchasing new articles of clothing. With more and more of our money going toward basic energy costs, there will be less and less available for other things.

A less obvious reason for recycling, but also an important one, is that the more "mileage" we get from what is already made or manufactured, the more natural resources we save in manufacturing and shipping. We're also saving petro-products which go into making synthetic fabrics.

Perhaps most important is the personal satisfaction gained from making something unwearable into something wearable.

Where do we find a "recyclable" garment? Recyclable clothing may be as close as your closet. You may have found some candidates for recycling during your wardrobe audit (Lesson 2). Rummage sales, garage sales and thrift shops are also sources of good used clothing which may have more wear-life.

Recycling can be a *simple* project or an *extensive* one. A simple recycling project may mean making a tunic out of a dress that is too short, or adding trim or lace to the bottom of a skirt to make it longer. Take a look at this list of "recycling" projects. You may even have done some of these before, but you may not have thought of them as "recycling."

1. Straighten the legs of wide bottom slacks or jeans to make them stylish.
2. Make an A-line skirt or straight skirt from a gathered skirt.
3. Make a sweater/vest from a sweater.
4. Make slacks or jeans into shorts.
5. Make a long-sleeved blouse or shirt into a sleeveless or short sleeve one.
6. Use fabric scraps to make placemats, pillows, quilts, accessories or craft items.
7. Add lace to the collar of a dress or change a collared neckline to one with a round or V-shaped neckline.
8. Change buttons on a garment to change the appearance.
9. Add a decorative applique to a garment.

Recycling can also be an extensive project, such as taking apart a woman's dress or coat or man's suit, and starting a new garment by laying pattern pieces on the dismantled garment. It is necessary to treat the dismantled pieces of cloth just the same as new fabric—checking for the straight of the grain, etc.

From a Woman's Coat Make These...

Before recycling a garment, consider these questions:

1. Is there enough fabric to make something new (or for alterations) and is the fabric worth saving?
2. Will the recycled garment make a contribution to the wardrobe? Will it save money?
3. Is the fabric suitable for the style, and the person for whom it is being made?
4. How advanced is the project? Will you have the time and patience to finish it?

To get ideas for a recycling project, check through catalogs, magazines or pattern books. Some other ideas for turning old into new can be found in the accompanying illustrations.

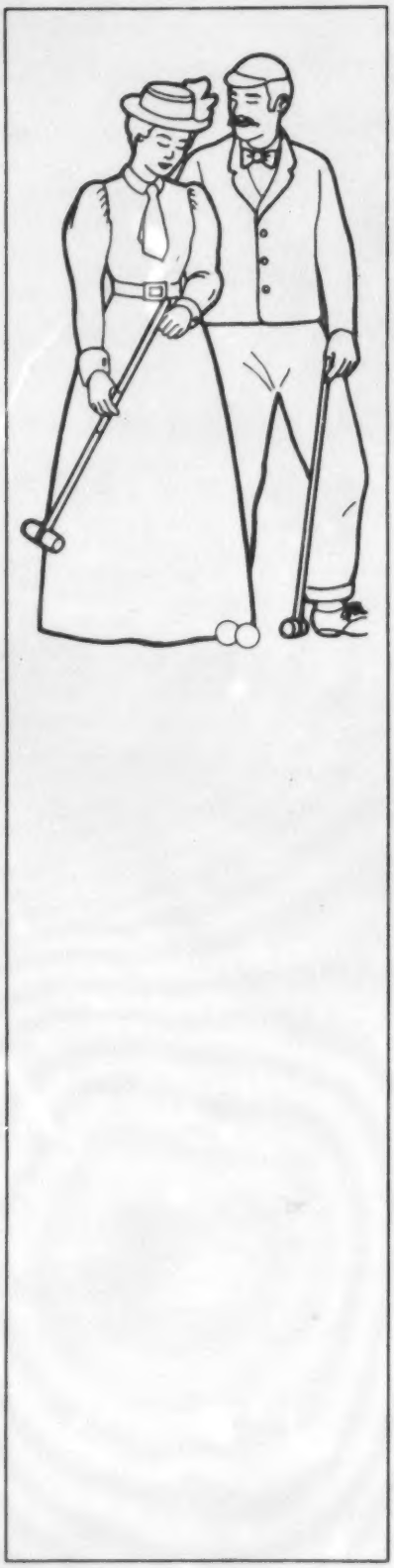
A recycled clothing project can be a creative, challenging and satisfying experience and can make a sizeable contribution to a well-managed wardrobe.

5 Family Living

Introduction

A study of energy management would not be complete without a look at the family—the people who use energy. Family energy management is a two-way street, the family's lifestyle choices influence how much energy it consumes. At the same time, energy supplies and costs influence those lifestyle decisions. This unit on Family Living includes the following lessons:

1. Entertainment
2. Getting into the Recycling Habit
3. Packaging—and Energy
4. Changing Lifestyles



Lesson 1 — Entertainment

Objectives: Upon completion of this lesson students will be able to list energy conserving ideas for use of entertainment appliances such as televisions and radios.

Background Information: Attached.

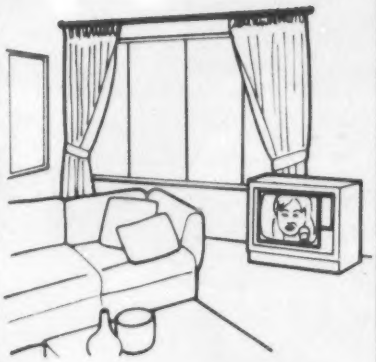
Activities:

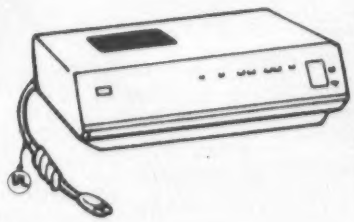
Discuss today's entertainment and recreation patterns and contrast with entertainment in grandmother's or great grandmother's day.

Resources: An Energy Education/Conservation Curriculum Guide for Home Economics Teachers, University of Tennessee and the U.S. Department of Energy, 1977.

Tips for Energy Savers, U.S. Department of Transportation, 1980.

Suggestions: Interview senior citizens about the entertainment and recreation activities of their youth.





Lesson 1 — Entertainment

With rising costs of gasoline more and more people are staying home instead of finding entertainment outside the home.

Some futurists predict that Americans will return to family games (cards, Monopoly,™ backgammon, etc.) or just plain good conversation for an evening's entertainment. And a once popular pastime—reading—will surely regain some popularity.

In 1970, 95 per cent of the households in the United States had television sets. As with all other appliances, television sets and other entertainment appliances should be used energy efficiently.

Don't leave television sets or radios on unnecessarily. An empty room doesn't need entertaining! Since a radio requires about 1/6th as much energy as a television set, it makes sense to use the radio when only listening to sports or other events.

Keep entertainment appliances free of dust. Dust on components and circuit boards causes inefficiency and overheating. Dust on the television screen greatly reduces picture quality and dusty recorders or record players do not produce quality sound. Most entertainment devices also need good air circulation to operate efficiently.

Records and tapes are petro-products. Many "hits" are recorded, sold, played and eventually discarded when new "hits" come along. Apparently no one knows how to do it yet, but recycling these petro-products would be a step in the right direction.

Buy from reputable dealers and look for the Underwriters' Laboratory (UL) tag on the cord *and* on the unit. As with other major appliances it may pay to buy the more expensive but energy efficient model.

Color television sets use twice as much energy as black and white television sets. Television wireless remote control units require extra energy, as does the "instant on" feature.

A relatively new product on the market is the video disc, a "record" which contains both audio and video and is played on a video disc player attached to the television set. The video disc feature allows one to watch movies, plays or other performances at home at the viewer's convenience. In the future libraries will make video discs available for check out just like books or records, and people will belong to video disc clubs.

The home entertainment business is almost certain to expand in the coming years, offering us new ways to use—and save—energy.

Lesson 2 — Getting into the Recycling Habit

Objectives: Upon completion of this lesson students will be able to list some of the advantages and limitations of recycling.

Background Information: Attached.

Activities:

FL#1 — Discussion Questions. Attached

Resources: "Exit Throwaway Era, Enter Recycling," U.S. News and World Report, March 19, 1979.

"Recycling is Worth the Hassle," Extension Bulletin EN0, Cooperative Extension Service, University of Missouri-Columbia.

"Recycling and the Consumer," pamphlet produced by the U.S. Environmental Protection Agency, Washington, D.C., 1974.

"Fairfax County Used Oil Recycling Program," brochure produced by Fairfax County Government and cooperating agencies.

Suggestions: To learn the location of recycling centers in Nebraska write to:

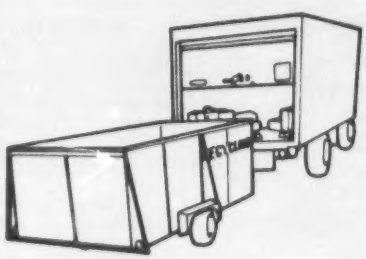
Nebraska Department of Environmental Control
Administrator of Litter Reduction and Recycling Programs
Box 98477 Statehouse Station
301 Centennial Mall South
Lincoln, Nebraska 68509 (402) 471-2186

Information is also available from:

National Association of Recycling Industries, Inc.
330 Madison Avenue
New York, New York 10017

or

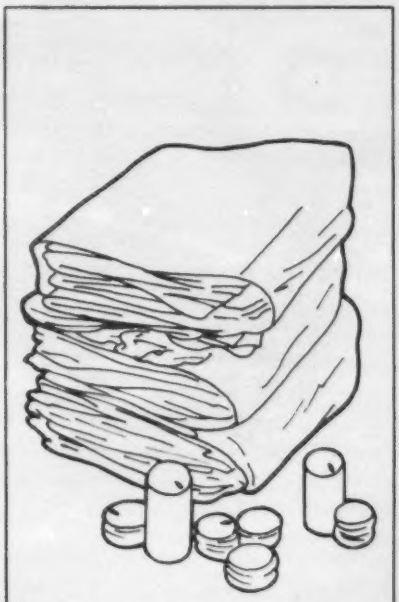
U.S. Environmental Protection Agency
Office of Solid Waste Management Programs
Washington, D.C. 20460

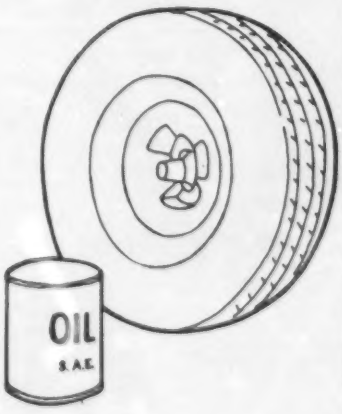


Other suggestions: Where possible, visit a recycling center.

Make a "recycling" bulletin board.

Plan and execute a recycling project for the school and/or community.





Lesson 2 — Getting into the Recycling Habit

America is known around the world as a "throw-away" society. It is a hard label to deny. Our "throw-away" society is a product of the post-World War II period when fuel and raw materials were cheap and plentiful. It was usually cheaper to throw away and buy something new rather than repair or recycle. Until recently, "recycling" didn't even appear as a word in dictionaries.

While we were enjoying this easy-come, easy-go life we were also depleting our supplies of natural resources; polluting the air, water and soil with our garbage; and watching energy costs creep upward.

Now, thanks to scientists who have pointed out the dangers of depleting the earth's resources by polluting the earth and atmosphere and exhausting our energy supplies, we are realizing that each person must become energy conscious. In the last few years recycling centers have popped up in cities and towns all over the nation.

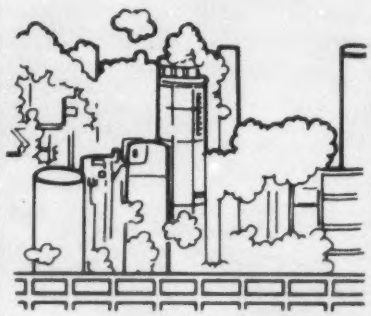
For most of us, recycling means saving newspapers or aluminum cans. However, many other things can be recycled. For instance, higher scrap metal prices are relieving some cities of problems with junkyards.

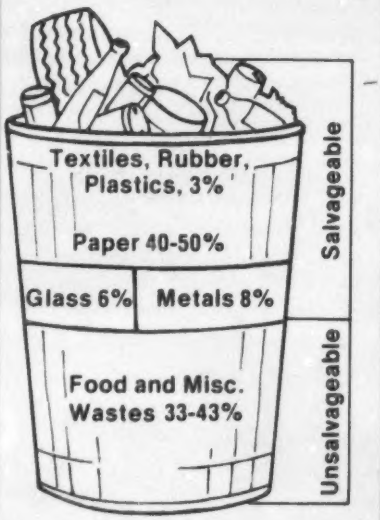
Old tires are being recycled too. About 200 million tires are discarded in the United States each year. An Ohio plant burns tires with coal to generate steam heat. In a southwestern state old tires are ground up and mixed with asphalt to create paving material. Worn out tires are used to create artificial reefs and breakwaters along U.S. coasts. And in our own state of Nebraska, a company converts old tires into rubber door mats.

As the cost of oil increases, the oil drained from vehicle crankcases is becoming too valuable to discard. Some states are passing laws which encourage or require the recycling of used lubrication oil. One county in Virginia has an extensive used motor oil recycling program. Service stations collect used motor oil and turn it over to recycling companies. Proponents of this type of recycling point out that it takes 42 gallons of *crude* oil to yield the same 2 1/2 quarts of lubricating oil provided by *re*-refining (recycling) 1 gallon of *used* oil. They say that Americans throw away approximately 350 million gallons of potentially recoverable motor oil each year and if this oil were recycled it would result in savings of 1.3 million barrels of oil *per day*.

The glass-packaging industry estimates that 600,000 tons of old glass is crushed and remelted each year to make new containers. Even this figure is a fraction of the amount of glass used in the U.S. In the Midwest the recycling system for used glass is as yet quite limited.

Making paper from recycled materials takes 40 per cent less energy than making new paper from wood. During World War II Americans recycled approximately 40 per cent of their paper. However, we got out of the habit, and just recently the recycling rate for paper was only 16 percent. It has been estimated that every Sunday edition of the *New York Times* consumes *150 acres* of forest. If we could just increase the amount of paper recycled from the present rate to 50 percent, we could save an additional 300 million trees per year!





Successful Recycling

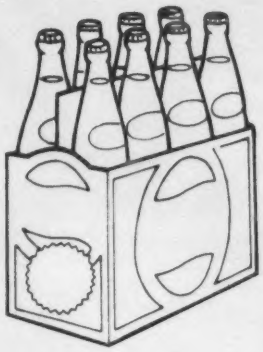
The most successful recycling program in the U.S. and probably also in Nebraska is the recycling of aluminum cans—approximately 25 per cent of the aluminum cans are being collected and recycled. Recycling can save about 95 per cent of the energy needed to produce cans from virgin ore. Recycling also helps manufacturers reduce the consumption of other natural resources. One aluminum can manufacturer points out that Americans recycled 6 times as many cans in 1978 as in 1972, and the trend is continuing upward. The aluminum recycling industry also points out that **1)** individuals and groups have earned thousands of dollars by turning in cans at rates up to 25¢ per pound; **2)** nearly 15,000 jobs have been created by recycling; and **3)** every recycling effort helps ensure a cleaner environment and prolongs our supply of natural resources.

In 1981 the U.S. House of Representatives reintroduced a "Container Deposit Bill" which would require a 5¢ refund for every beverage container. The General Accounting Office has estimated that such a bill would reduce litter by 80 percent and reduce the energy consumption for manufacturing and transporting beverage containers by 30 percent. While it is doubtful that such a bill will pass soon, it is encouraging that the Congress is aware of the importance of legislation in this direction.

All over our country people are devising ways to recycle other products. A number of cities supply some or most of their energy requirements by burning municipal waste. Garbage can be burned to make steam for heat or processed to make solid fuels. Sludge from sewage treatment plants can be recycled rather than dumped into the ocean or into landfills. Waste conversion plants have been designed which convert animal manure into methane gas which is then burned to produce electricity or to convert the manure into protein for livestock feed. Experiments are underway to convert cheese whey into alcohol as an additive for gasoline which will supplement the alcohol processed from corn. Sawmill residues are used for heat in some heavily wooded areas. A photo company has developed a method of recovering the silver from chemicals used in the developing process. The list—and the statistics—go on and on.

According to the Environmental Protection Agency (EPA) more than half of the waste from the typical family is made up of salvageable materials. In Nebraska the biggest drawback is a lack of markets for the recovered materials. There are a number of aluminum recycling and newspaper collection agencies in Nebraska but in some cases the distance between cities does not make recycling easy.

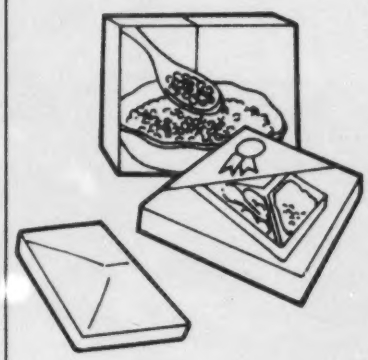
As our supplies of natural resources get smaller, it is in our personal interest to promote every reasonable conservation effort. Indeed, it is our responsibility to become recyclers because our energy future depends on us.



FL#1
Getting into the Recycling Habit

Discussion Questions

1. What recycling centers are available in our area? (A check with local Chamber of Commerce, city council, newspaper, County Extension Office or state Department of Environmental Control could probably reveal the nearest recycling centers). What items can be recycled? Are the hours of recycling centers well publicized? Is information concerning recycling centers easily available?
2. What items can be recycled at home or school aside from the traditional newspapers, cans or glass? (Seek answers such as egg cartons, grocery sacks, paper towels, bread sacks, plastic bags, aluminum foil, etc.) Do you buy milk in throw-away cartons or in returnable bottles? Soft drinks? Eggs?
3. If recycling centers for the most common products are some distance away, how can you still save and contribute to the recycling effort? (Buy soft drinks in returnable bottles, etc.) What could be done in your community to make recycling worth the effort?
4. What reasoning for recycling would you give to someone who consistently uses soft drinks and discards the aluminum cans, making no effort to recycle?
5. What are you doing in the classroom to promote recycling? (Do you throw away plastic bags after one use, or wash and re-use them?)
6. What are some examples of wasted energy or natural resources in your school?



Lesson 3 — Packaging—and Energy

Objectives: Upon completion of this lesson students will be able to list the reasons some packaging is necessary and list some concerns about overpackaging.

Background Information: Attached.

Activities:

FL#2 — Discussion Questions. Attached

Resources: "The Consumer's Right to Know," Kraft, Inc., Glenview, Illinois, August 1980.

"Buy the Product, Not the Package," Changing Times, the Kiplinger Magazine, April 1977.

"Excess Packaging and the Energy Crisis," Special Edition Story No. 45, Cooperative Extension Service, University of Nebraska-Lincoln, 1974.

"Watch for the New Food Packages," Changing Times, April 1981.

Suggestions: Make a bulletin board of packaging examples.

Prepare presentations on excess packaging to be given to other classes, clubs or organizations.

Bring samples of excess packaging, and general packaging samples, to class.

Lesson 3 — Packaging—and Energy

Closely related to the concerns we have about recycling is the question: "Where do all our throw-aways come from?" Nearly half of the waste accumulated by a typical family is made up of paper products. And nearly half of that paper is in the form of packaging. A look at packaging habits in our country may add new perspectives to our study of energy management and conservation of our natural resources.

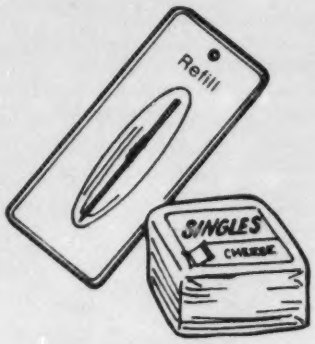
America uses more packages than any other country in the world. It has been estimated that the average homemaker opens 1700 packages every year. Almost half of these packages and containers are used for food. While packaging is necessary in many cases, it is expensive and can cause disposal problems.

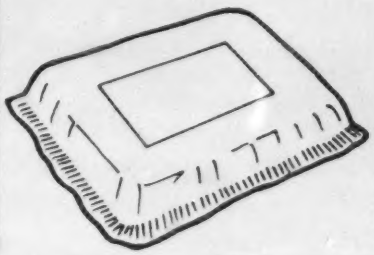
Packaging comes to us for a variety of reasons. The packaging industry points out that packaging is necessary to:

1) **Protect the product.** This means protecting the product from contamination, spoilage and physical damage from handling or during transit or storage.
2) **Preserving food quality and nutritive value.** This means maintaining the characteristic color, flavor, texture, consistency, appearance and overall freshness of the product. Contact with air, moisture and light can hasten the deterioration of food quality and destroy nutrients.
3) **Provide convenience.** This is in regard to transportation, storage, display and consumer use of the product.
4) **Convey information.** The Fair Packaging and Labeling Act requires that consumer products moving in interstate commerce be honestly and informatively labeled by including net weight or volume. Ingredients in decreasing order of predominance by weight (except those products which have standardized ingredients such as mayonnaise) must be stated on the label. If the manufacturer wants to list the number of servings, they must also list the net contents of each serving. The name of the product and the name and address of the manufacturer or distributor must be stated in English on the label.
5) **Prevent shoplifting.** Shoplifting is at an all time high for reasons beyond the scope of this lesson; it has certainly had an effect on labeling and packaging.

A Close Look at Packaging

A close look at packaging will also show, for instance, that packaging is designed to "sell" the product by catching the customer's attention. Motivational research and marketing techniques are integral to package design. The agencies which conduct these studies consider color, design, novelty and the psychology of buying in designing a package. Researchers have found, for instance, that pastel colors are usually associated with elegance and bright hues foster feelings of aggression and forwardness. Researchers also find that consumers are intrigued with novelty, such as the drain cleaner which comes in the package shaped like a drain pipe. One of the most successful packages is the "egg" which contains hosiery. Packaging can





also convey feelings of strength, femininity, ruggedness, happiness and safety, to name only a few examples.

But is *all* this packaging necessary? For example, a single ballpoint pen refill is encased in a plastic bubble attached to a piece of cardboard several times its size. This is done primarily to prevent shoplifting.

A study done at the University of Illinois showed that Americans pay about $25 billion annually for packaging and we throw 90 per cent of it away! Excess packaging is a significant drain on our resources and creates disposal problems. Some packaging is recyclable; others are not. However, plastics continue to be a problem. They smoke and get sticky when burned, and are not bio-degradeable.

And packaging costs money. In 1979 packaging alone accounted for 12¢ of every food dollar. While it may seem handy to have powdered juice in pre-measured individually wrapped portions, remember that the packaging is included in the cost. It may be "handy" to have cheese in individually wrapped slices, but we're accumulating more plastic waste to be paid for, then disposed of, when we buy it that way.

The Environmental Protection Agency (EPA) has asked manufacturers to design products which will reduce solid waste disposal. Redesigning could cut down on product costs as well as the use of natural resources. The EPA cites this example: to change the design of a half-pint container of milk from a square base of 2 3/4 inches to 2 1/2 inches would require about 31 per cent less paper. The EPA estimates that making this change nationwide would save 59,000 tons of paper per year.

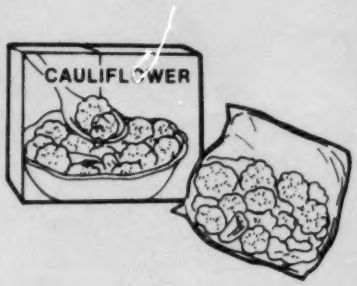
Recent developments in packaging will reduce some of the energy costs associated with packaging and storage. When the astronauts landed on the moon in 1969 they carried food in "retort pouches."

The retort pouch is a thin, three-layer laminate of polyester, aluminum foil and a polyolefin blend. Food is placed in the pouch and then the pouch is sealed and sterilized at temperatures of 240-250° F. Pouched food can be heated in hot water or a microwave oven. As a result of the heat process used to package items in retort pouches, refrigeration or freezing is not necessary. These "shelf stable" foods simply sit in a warehouse or on a store shelf until they are used.

Retort pouches, though initially expensive, contribute to energy and cost savings because the food requires shorter processing times, less storage space, less spoilage, lighter packages for less expensive transport and simple storage requirements. Industry studies say that the total cost of processing, packaging and distributing food in retort pouches is 50 percent less than for frozen foods. Retort pouches are being test marketed in various parts of the United States.

What is your responsibility as a consumer?

Be selective in your choice of products. Don't be taken in by pretty packages; consider products because of their use and quality. Compare labels, for weight and contents, with other packages and products. Get the most for your money. Don't buy



packaging if you don't need it such as individual cheese slices. Be aware that "convenience" containers, (i.e. those which go directly into the oven or microwave oven) are more costly than others.

Finally, express your concerns about excess packaging to the manufacturers and retailers. Remember that the best package is one which protects the product with the lowest production and disposal costs.

FL#2
Packaging—and Energy

Discussion Questions

1. What packaging and labeling practices seem to be concerned with making shoplifting more difficult?
2. What packaging and labeling practices seem to be concerned more with selling the product and catching the consumer's attention?
3. What packaging practices seem to be concerned more with consumer convenience?
4. What packaging practices seem to be more concerned with protection of the product?
5. What information can be found on a product label?
6. What packaging practices are tied to tradition? (Ketchup bottles, pickle jars, etc.)

Lesson 4 — Changing Lifestyles

Objectives: Upon completion of this lesson students will be able to list some ways our lifestyles have affected the energy situation, and some ways the energy situation is affecting our lifestyles.

Background Information: Attached.

Activities: Class discussions.

Resources: "Battle of the Sexes, Men Fight Back," U.S. News and World Report, December 8, 1980.

"Meeting Changing Lifestyles," a compilation of speeches from the 28th National Home Appliance Conference, sponsored by Association of Home Appliance Manufacturers, 1976.

Suggestions: Bulletin board on the status of women and their effect on lifestyle changes.

Lesson 4 — Changing Lifestyles

Today many factors contribute to our changing lifestyles—lifestyles which have changed drastically since the turn of the century.

Over the years, we have become an energy intensive society. Americans use about one third of the world's energy supplies and yet account for only six percent of the world's population. Of course, our country produces more than any other country of the world but it is also true that many European countries maintain a comparable standard of living while using only half the amount of energy per capita. Let's take another example. The United States, with a population of about 213 million, consumes more energy for air conditioning than 800 million Chinese use for everything!

The United States Office of Emergency Preparedness says that Americans could save 30-50 per cent of the energy we use without reducing our quality of life. Many people tend to equate conservation with curtailment. Curtailment means cutting back fiercely. Conservation means wise management. Curtailment might mean a cold house, while conservation means a well-insulated, weatherstripped and caulked house with an efficient heating system. Experts say that half of the energy we use is wasted.

Why have we been using energy in such enormous amounts? What kind of people are we? Let's take a look at who we are.

The average American is older than ever before. More of us are single because marriage is no longer "required" of young men and women. More of us live in apartments, condominiums and duplexes. Nationwide, approximately four in ten marriages ends in divorce, contributing to the increase of single heads of households. Nearly 1/4 of all households are "single" households.

We have smaller families than ever before, and devote less time to necessities such as laundering and cooking. Only seven percent of the families are so-called "traditional" families with a working husband, homemaker wife and two children at home.

Our lives have become more hectic because of greater involvement in civic, social and recreational activities.

Fifty-two percent of our work force is made up of females. Five and a half million mothers with pre-school age children are working. It is predicted that by 1990 70 per cent of all working-age females will be in the work force.

More families eat meals on a "split-shift"—eating whenever and wherever they can fit food into other activities. This "split-shift" eating schedule is partially responsible for the popularity of the microwave oven, which can thaw or prepare food in short periods of time. And this is but *one* example of the conveniences we have adopted in our homes to meet our changed lifestyle.

Some experts say that the energy crisis of 1973-74 was the turning point in our energy history. That energy crisis made us aware of the need to focus attention on conservation, energy independence, new energy sources and sound management practices.

We are now beginning to see some progress in those efforts to conserve energy supplies. The U.S. Department of Energy has

released figures showing that overall energy consumption dropped approximately 3-4 per cent from 1979 to 1980. Nebraska Energy Office statistics show that Nebraskans reduced their total energy consumption by just over 4 per cent and that Nebraskans used nearly 11 per cent less gasoline in 1980 compared to 1979. This is an accomplishment.

Energy *can* be conserved with voluntary efforts. Energy concerns *are* causing a shift in our lifestyles. And energy concerns will probably have an even greater impact on lifestyles in the years ahead.

Resources

The Resource section contains the following information:
Visuals (Figures 1-12)
Bibliography
Audio-Visual Suggestions
Acknowledgements

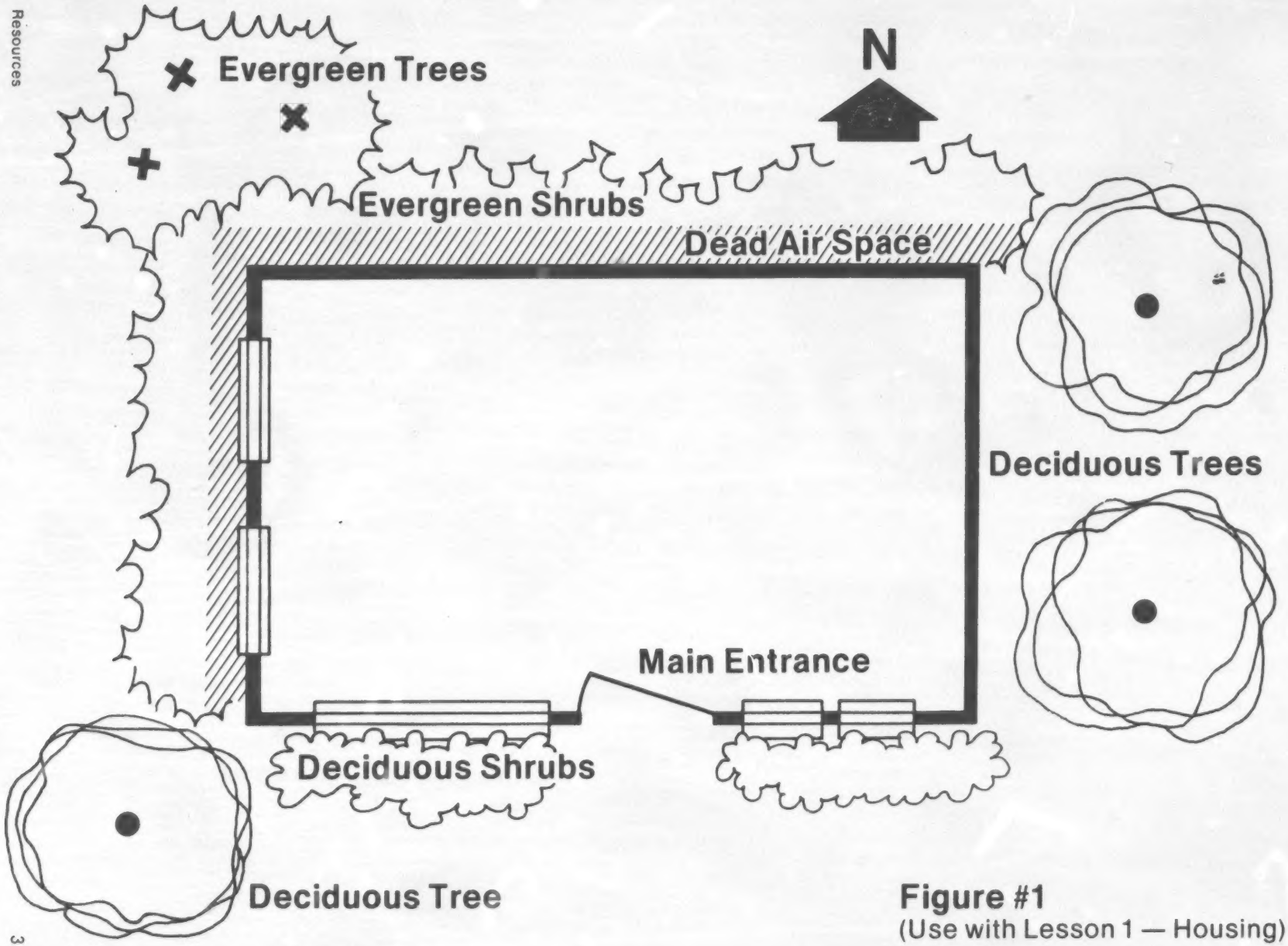
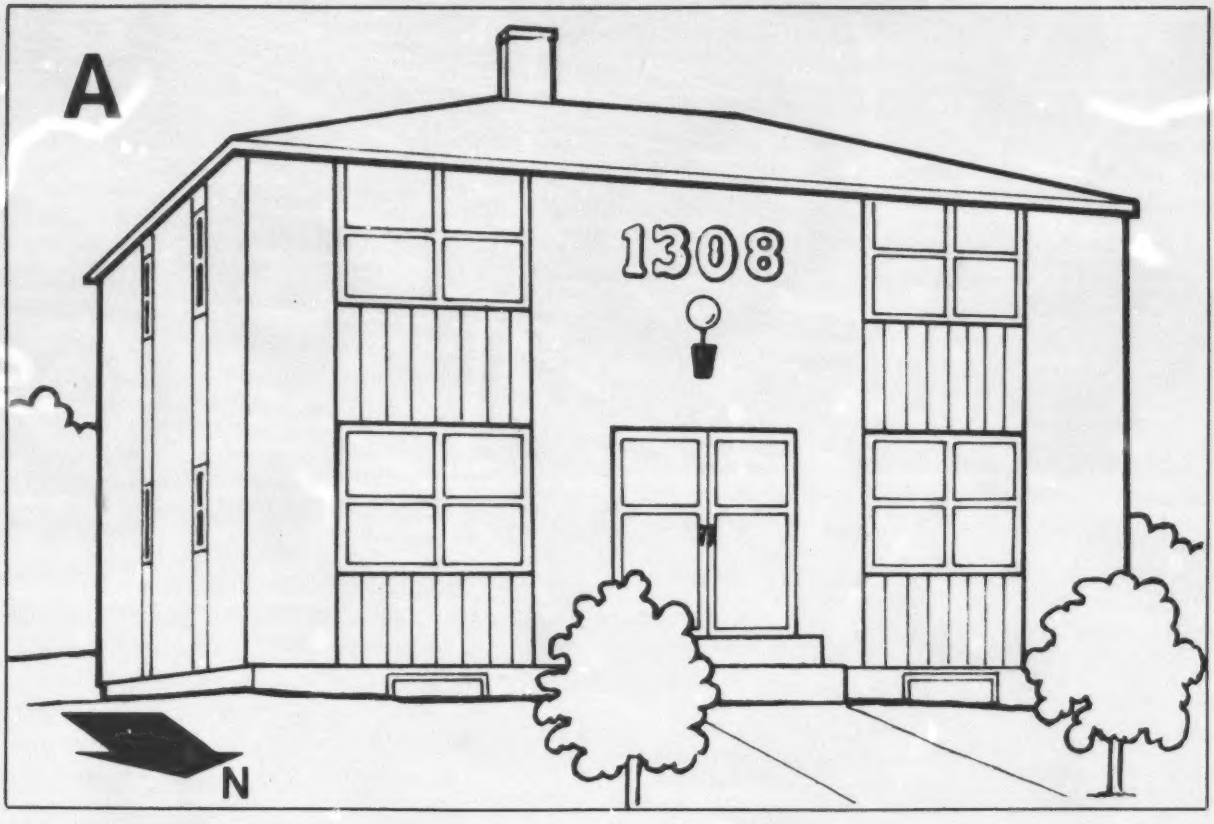


Figure #1
(Use with Lesson 1 — Housing)

Figure #2
(Use with Lesson 2 — Housing)



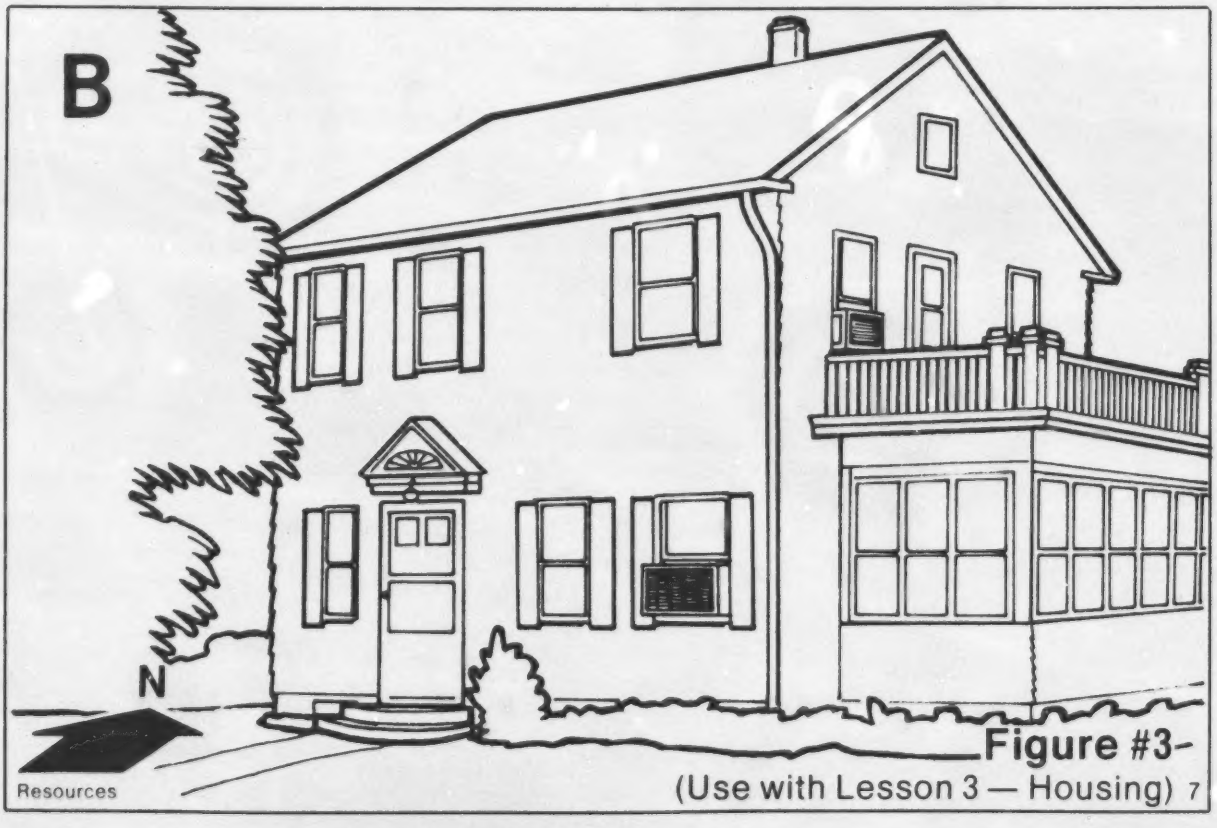


Figure #3-

(Use with Lesson 3 — Housing) 7

Resources

Figure #4
(Use with Lesson 5 — Housing)

Fluorescent Lamp Selection Guide

	Effect on "Atmosphere"	Colors Strengthened	Colors Weakened or Grayed	Remarks
Cool white	neutral to fairly cool	orange, yellow, blue	red	blends with natural daylight
Deluxe cool white	neutral to fairly cool	all nearly equal	none appreciably	simulates natural daylight
Warm white	warm	orange, yellow	red, blue, green	blends with incandescent light
Deluxe warm white	warm	red, orange, yellow, green	blue	simulates incandescent light

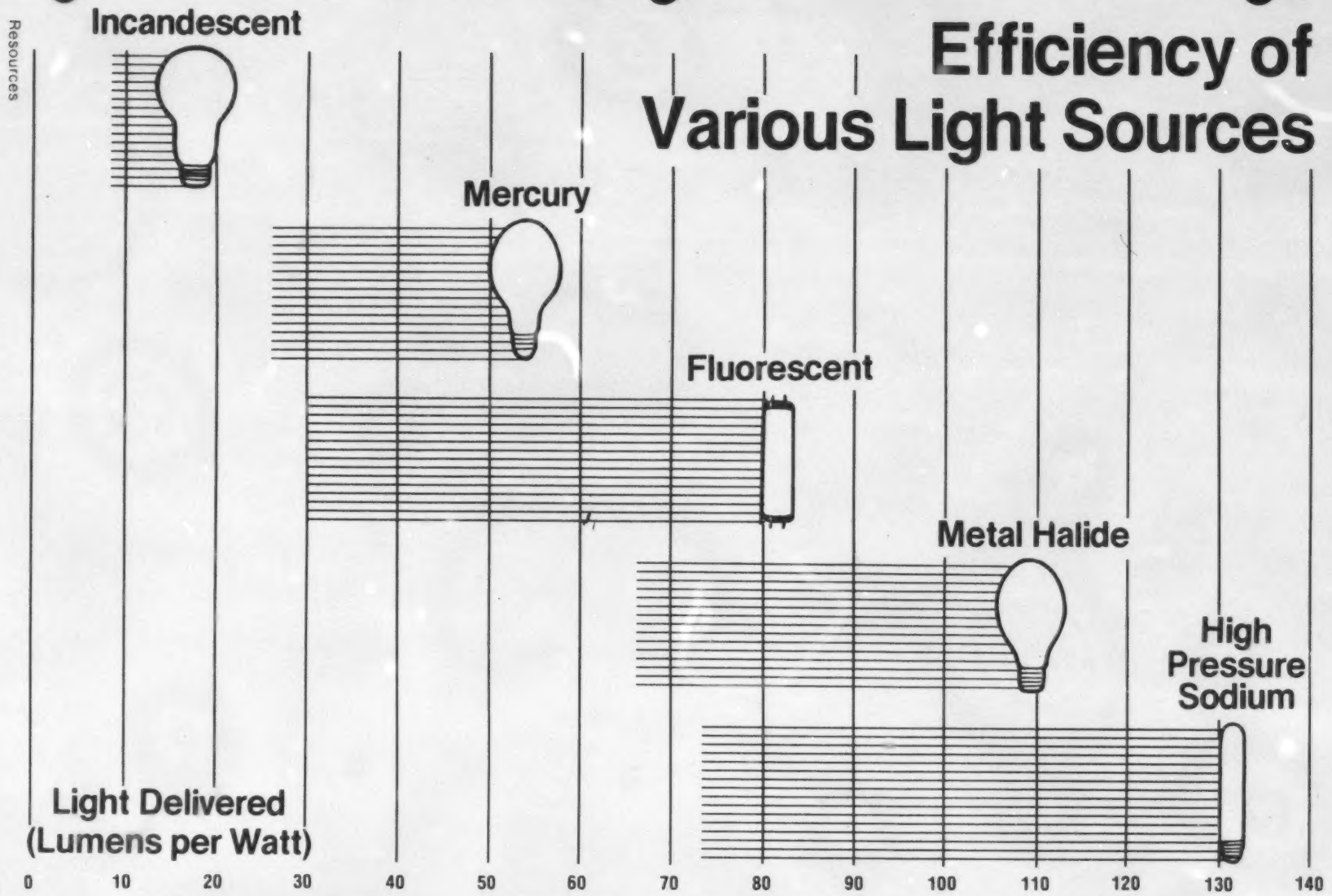


Figure #5
(Use with Lesson 5 — Housing)

Resources
Figure #6
(Use with Lesson 7 — Housing)
13

Resources

Figure #7

(Use with Lesson 7 — Housing)

15

ENERGY DATA
ASSOCIATION OF HOME APPLIANCE MANUFACTURERS

Product	Average Operating Wattage	No. of Uses Per Year	Time/Use (Min.)	Hours/ Year	% Actual "On Time"	kWh/ Year
Baby Food Warmer	165	1092	7.3	131.0	100	22.0
Bag/Maker Sealer	60	350	1.25	7.3	100	0.4
Blanket	150	180	480.0	1440.0	50	108.0
Blender	300	293	0.5	2.4	100	0.7
Broiler	1200	100	45.0	75.0	100	90.0
Can Opener	100	1000	0.2	3.3	100	0.3
Coffee Maker/Percolator						
Brew Cycle	600	600	15.0	150.0	100	90.0
Warm Cycle	80	600	60.0	600.0	100	48.0
Coffee Maker/Urn						
Brew Cycle	1200	18	30.0	9.0	100	10.8
Warm Cycle	100	18	120.0	36.0	100	3.6
Coffee Maker/Drip						
Brew Cycle	1100	600	12.0	120.0	100	132.0
Warm Cycle	70	600	60.0	600.0	100	42.0
Coffee Mill	150	360	0.5	3.0	100	0.4
Corn Popper						
Hot Air	1400	100	5.0	8.3	100	11.6
Oil	575	100	9.0	15.0	100	8.6
Curling Iron	40	300	10.0	50.0	82	1.6
Cooker Fryer/						
Dutch Oven	1200	35	60.0	35.0	54	22.7
Crepe Maker	750	52	30.0	26.0	70	13.6
Deep Fryer						
Regular	1500	50	50.0	41.6	50	31.2
Mini	600	50	30.0	25.0	70	10.5
Egg Cooker	600	175	5.0	14.6	100	8.8
Fondue/Chafing Dish	800	25	60.0	25.0	46	9.0
Food Grinder	200	100	15.0	25.0	100	5.0
Food Slicer	100	52	10.0	8.7	100	0.9
Frypan	1200	180	45.0	135.0	62	100.4
Griddle	1200	100	30.0	50.0	76	45.6
Hair Clipper	10	200	10.0	33.3	100	0.3
Hairdryer						
Soft Bonnet	400	100	45.0	75.0	100	30.0
Hard Bonnet	900	100	30.0	50.0	100	45.0
Hand-Held	1000	250	8.0	33.3	100	33.3
Hair Setter	350	156	15.0	39.0	75	10.2
Hamburger Maker	750	100	20.0	33.3	90	22.5
Heating Pad	60	52	120.0	104.0	54	3.4
Hot Beverage Maker						
Instant	1000	600	3.0	30.0	100	30.0
Ice Cream Freezer	130	6	45.0	4.5	100	0.6
Ice Crusher	100	100	3.0	5.0	100	0.5
Iron	1100	52	120.0	104.0	52	59.5
Juicer	125	100	2.0	3.3	100	0.4
Kettle	1500	600	5.0	50.0	100	75.0
Knife	95	90	5.0	7.5	100	0.7
Knife Sharpener	40	52	5.0	4.3	100	0.2
Lighted Mirror						
Incandescent	50	650	10.0	108.3	100	5.4
Fluorescent	20	650	10.0	108.3	100	2.2
Massager						
Hand-Held	15	104	10.0	17.3	100	0.3
Foot	135	100	30.0	50.0	100	6.8
Mixer						
Hand	100	150	5.0	12.5	100	1.3
Stand	150	75	8.0	10.0	100	1.5
Pizza Maker	600	52	20.0	17.3	100	10.4
Roaster	1425	12	360.0	72.0	58	60.0
Rotisserie	1400	26	120.0	52.0	100	73.0
Shaver	15	265	5.0	30.0	100	0.5
Shaving Cream						
Dispenser	60	365	1.0	6.0	100	0.4
Slow Cooker	200	104	400.0	693.0	100	138.6
Table Range	1250	100	30.0	50.0	75	46.9
Table Clothes Washer	100	100	30.0	50.0	100	5.0
Toaster	1100	700	3.0	35.0	100	38.5
Toaster-Oven/Broiler						
Toasting	1500	500	3.0	25.0	100	37.5
Oven	1500	280	30.0	140.0	26	54.6
Broiler	830	156	30.0	78.0	71	45.9
Toothbrush with						
Charger	1.1	Cont.	Cont.	8760.0	100	10.0
Waffle/Baker						
Sandwich Grill	1200	52	30.0	26.0	80	24.9
Warming Tray	140	26	120.0	52.0	50	3.6
Yogurt Maker	25	26	600.0	260.0	40	2.6

*Factor for the effect of on-off cycling in thermostatically controlled products.

Figure #8
(Use with Lesson 9 — Housing and Lesson 5 — Foods and Nutrition)

A Sample Energy Cost Label

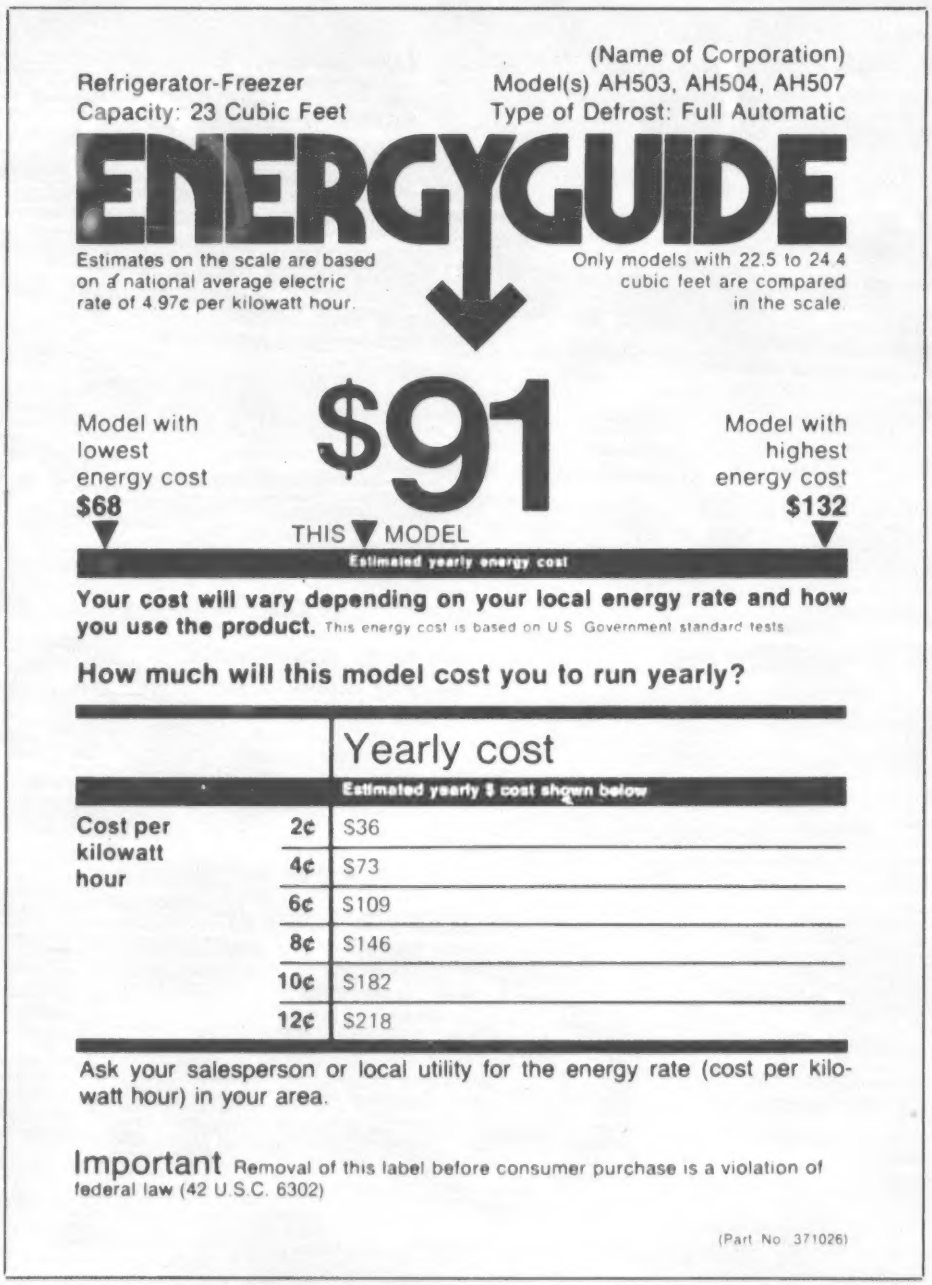
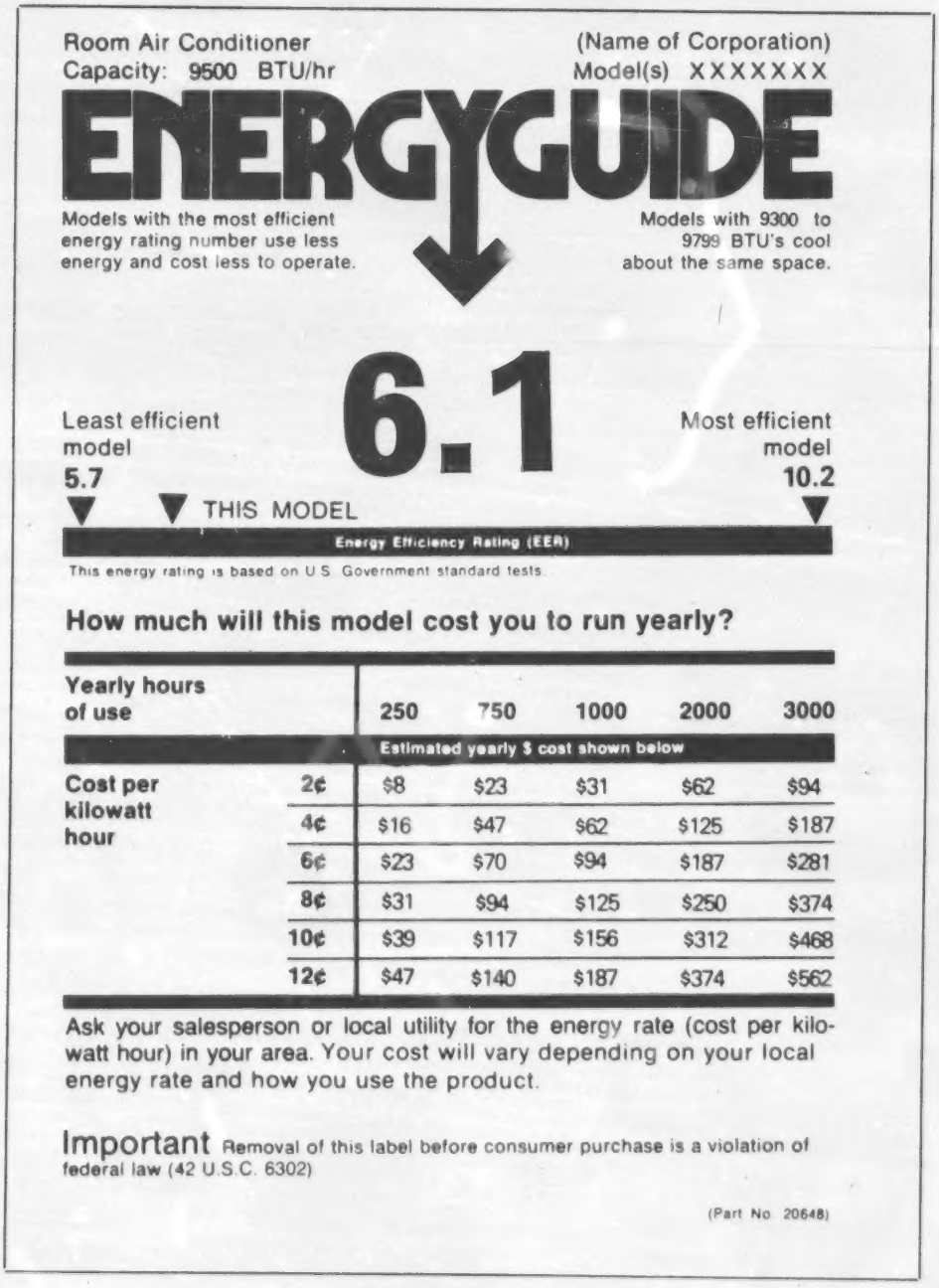

(Name of Corporation)
Refrigerator-Freezer
Model(s) AH503, AH504, AH507
Capacity: 23 Cubic Feet
Type of Defrost: Full Automatic
ENERGYGUIDE
Estimates on the scale are based on a national average electric rate of 4.97¢ per kilowatt hour.
Only models with 22.5 to 24.4 cubic feet are compared in the scale.
Model with lowest energy cost
$68
$91
THIS MODEL
Model with highest energy cost
$132
Estimated yearly energy cost
Your cost will vary depending on your local energy rate and how you use the product. This energy cost is based on U.S. Government standard tests.
How much will this model cost you to run yearly?
Yearly cost
Estimated yearly $ cost shown below
Cost per kilowatt hour
2¢ $36
4¢ $73
6¢ $109
8¢ $146
10¢ $182
12¢ $218
Ask your salesperson or local utility for the energy rate (cost per kilowatt hour) in your area.
Important Removal of this label before consumer purchase is a violation of federal law (42 U.S.C. 6302)
(Part No. 371026)

Figure #9
(Use with Lesson 1 — Foods and Nutrition)

• A Sample Energy Efficiency Label



Room Air Conditioner
Capacity: 9500 BTU/hr

(Name of Corporation)
Model(s) XXXXXXX

ENERGYGUIDE

Models with the most efficient energy rating number use less energy and cost less to operate.

Models with 9300 to 9799 BTU's cool about the same space.

Least efficient model
5.7

6.1

Most efficient model
10.2

▼ THIS MODEL

Energy Efficiency Rating (EER)

This energy rating is based on U.S. Government standard tests.

How much will this model cost you to run yearly?

Yearly hours of use		250	750	1000	2000	3000
		Estimated yearly $ cost shown below				
Cost per kilowatt hour	2¢	$8	$23	$31	$62	$94
	4¢	$16	$47	$62	$125	$187
	6¢	$23	$70	$94	$187	$281
	8¢	$31	$94	$125	$250	$374
	10¢	$39	$117	$156	$312	$468
	12¢	$47	$140	$187	$374	$562

Ask your salesperson or local utility for the energy rate (cost per kilowatt hour) in your area. Your cost will vary depending on your local energy rate and how you use the product.

Important Removal of this label before consumer purchase is a violation of federal law (42 U.S.C. 6302)

(Part No. 20648)

Figure #10
(Use with Lesson 1 — Foods and Nutrition)

A Sample Generic Label

(For Furnaces)

ENERGYGUIDE

You can save substantially on home heating and cooling energy costs by following the simple steps outlined below:

1. Weatherproof your house
2. Assure energy efficient heating and cooling equipment selection and installation
3. Operate and maintain your system to conserve energy.

Help conserve energy. Compare the energy efficiency rating and cost information for this model with others. Check the figures and spend less on energy.

Your contractor has the energy fact sheets. Ask for them.

Important Removal of this label before consumer purchase is a violation of federal law (42 U.S.C. 6302)

Figure #11
(Use with Lesson 1 — Foods and Nutrition)

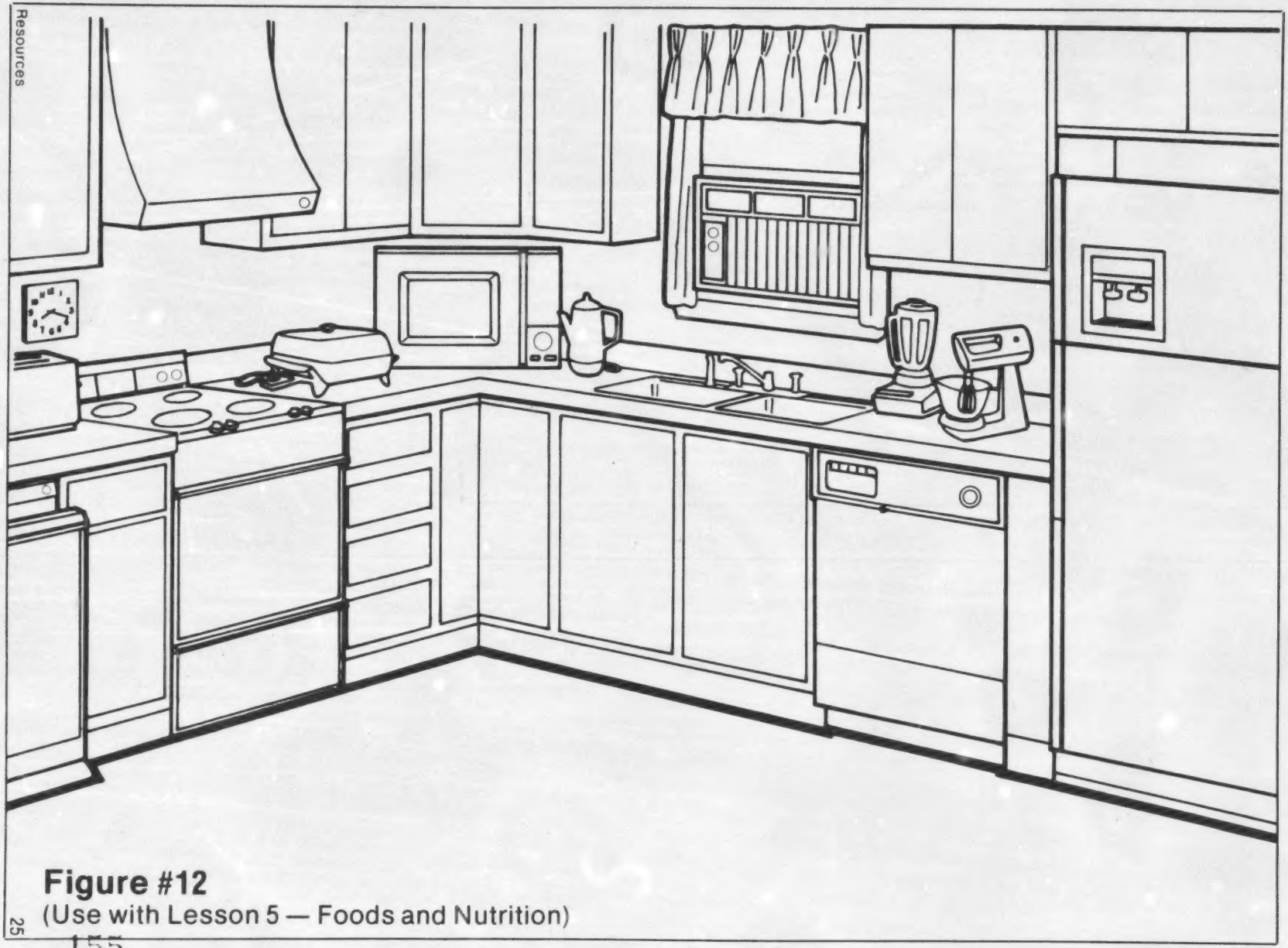


Figure #12
(Use with Lesson 5 — Foods and Nutrition)

Bibliography

Asterisk indicates highly recommended reading.

Allen, Phyllis S. **Beginning an Interior Environment.** Provo, UT: Brigham-Young University Press, 1972.

Association of Home Appliance Manufacturers. **Meeting Changing Lifestyles.** 28th National Home Appliance Conference. Chicago: n.p., 1976.

Baldwin, Keturah E. **The AHEA Saga.** Washington, D.C.: American Home Economics Association, 1949.

"Battle of the Sexes—Men Fight Back." **U.S. News and World Report.** Dec. 8, 1980, pp. 50-54.

Brown, Lester R. **By Bread Alone.** New York: Praeger Publishers, 1974.

"Buy the Product, Not the Package." **Changing Times.** April, 1977, pp. 21-23.

*Cho, Emily, and Linda Grover. **Looking Terrific.** New York: G.P. Putnam's Sons, 1978.

Coats and Clark, Inc. **Saving Energy with Clothing and Textiles.** Stitch in Time Reference Leaflet 2206, Vol. 49, No. 2R. Stamford, CT: n.p., n.d.

Cooperative Extension Service, University of Illinois at Urbana-Champaign. **Saving Energy with What You Wear.** North Central Regional Extension Publication No. 73. Urbana, IL: n.p., 1979.

Cooperative Extension Service, Michigan State University. **Saving Energy and Doing Laundry.** Extension Bulletin E-1121. E. Lansing, MI: n.p., Reprinted March, 1978.

_____. **Window Treatments for Thermal Comfort.** Extension Bulletin E-1141. E. Lansing, MI: n.p., October, 1977.

Cooperative Extension Service, University of Missouri-Columbia. **Energy—Recycling is Worth the Hassle.** Columbia, MO: n.p., 1976.

Cooperative Extension Service, University of Nebraska-Lincoln. **Excess Packaging.** Lincoln, NE: n.p., n.d.

_____. **Extension Circulars**

EC 71-478. "Restyling Sweater Knits." 1971.
EC 77-2046. "The House and The Site." 1977.
EC 79-1205. "Landscaping Your Home . . ." 1979.
EC 80-2052. "Window Treatments for Energy Efficiency." 1980.
EC 80-2053. "Planning an Energy Efficient Home." 1980.
Lincoln, NE: n.p.

_____. **NebGuides**

G80-508. "Landscaping and the Climate Around Your Home." 1980.
HEG 77-60. "Restyling or Remodeling a Garment." 1977.
HEG 77-85. "Energy Choices in the Kitchen." 1977.
HEG 77-86. "Winning Ways with Water." 1977.
HEG 77-87. "Be Aware of What You Wear." 1977.
HEG 78-90. "Selection, Care, Use—Your Electric Blanket." 1978.
HEG 78-94. "Electrical Appliances and the Energy $." 1978.
HEG 78-95. "Easy on Energy—With Appliances." 1978.
HEG 78-96. "Easy on Energy—At Home." 1978.
HEG 79-107. "Constructing A Solar Oven." 1979.
HEG 79-109. "Functional Fashions for You." 1979.
HEG 80-111. "How to Make Insulated Roman Shades." 1980.
Lincoln, NE: n.p.

Cooperative Extension Service, North Dakota State University. **Cut Cooling Costs: Keep Cool With Clothing.** Extension Circular HE-351. Fargo, ND: n.p., 1978.

Cooperative Extension Service, Purdue University. **Energy in the Home . . . Changing Your Habits.** Bulletin HE 407. West Lafayette, IN: n.p., n.d.

Cornell Cooperative Extension Energy Task Force. **Save Energy, Save Dollars.** Ithaca, NY: Cornell University, 1977.

Deacon, Ruth E. and Francille M. Firebaugh. **Home Management: Context and Concepts.** Boston: Houghton Mifflin, 1975.

DeLong, Deanna. **Hot To Dry Foods.** Tucson, AZ: H.P. Books, 1979.

Douglas, Carole Nelson. "Light Up Your Life Effectively." **Energy Horizons.** Winter, 1978, pp. 12-14.

Eberlein, Cathy. "Window Wizardry." **Energy Horizons.** Fall, 1978, pp. 6-7.

Energy: The Next Twenty Years. A Report of a Study Group sponsored by the Ford Foundation, administered by Resources of the Future. Cambridge, MA: Ballinger Publishing Co., 1979.

Executive Office of the President, Energy Policy and Planning. **The National Energy Plan.** Cambridge, MA: Ballinger Publishing Co., [1977].

"Exit Throwaway Era, Enter Recycling," **U.S. News and World Report.** March 19, 1979, pp. 58-60.

Fairfax County, VA. **Fairfax County Used Oil Recycling Program.** n.p., n.d.

Federal Energy Administration (now: U.S. Department of Energy). **Tips for Energy Savers.** Washington, D.C.: GPO, 1977.

Ford, Barbara. **Future Food.** New York: William Morrow, 1978.

Framey, Mel. "Homeowner's Guide to Energy Efficient Lighting," **Home Energy Digest.** Summer, 1980, pp. 96 ff.

Gas Research Institute. **Residential Energy Consumption: Baseline Comparison of Single Family Detached Homes.** Chicago: GRI, 1979.

General Electric Company. **The Combination Range Guide and Cookbook.** n.p., n.p., 1980.

A Guide to Preserving Food for a 12 Months Harvest. San Francisco, CA: Ortho Book Division, 1975.

Harris, Michael. "Shades and Shutters," **Home Energy Digest.** Fall, 1980, pp. 127 ff.

Kraft, Inc. **The Consumer's Right to Know.** Glenview, IL: n.p., 1980.

The Maytag Company. **For Better Laundry Results.** n.p., n.d.

*Mazria, Edward. **The Passive Solar Energy Book.** Emmaus, PA: Rodale Press, 1979.

Minnegasco. **Facts about Energy Efficient Home Decoration.** n.p., n.d.

_____. **Humidity and the Indoor Environment.** n.p., n.d.

_____. **Microwave Ovens.** n.p., n.d.

Morrison, James W. **The Complete Energy Saving Handbook for Homeowners.** Nebraska Energy Saving Manual. New York: Harper & Row, 1979.

*The National Geographic Society. **Energy: A Special Report.** Washington, D.C.: February, 1981.

Nebraska Public Power District. **Home Energy Conservation. n.p., n.d.**

_____. **Portables for the '80's.** n.p., n.d.

"New! Energy Ratings for Appliances," **Good Housekeeping.** June, 1980, p. 162.

Nichols, Nell and Betsy McCracken. **Cook It Your Way.** New York: Doubleday, 1979.

Northern Electric Company. **Electric Blankets: How to Save Energy Without Being Left in the Cold.** Chicago: n.p., n.d.

Pillsbury Kitchens' Family Cookbook. Minneapolis, MN: Pillsbury Publications, 1979.

Rothchild, John. **Put Your House to Work Saving Money for You! Houston, TX:** Exxon Marketing Publications, n.d.

*Sherwood, Ruth F. **Homes Today and Tomorrow.** 2nd ed. Peoria, IL: Bennett Publishing Co., 1981.

Skinner, Gail. "Cut Heating Costs, Insulate Yourself—With Your Clothes!" **Nebraska Farm, Ranch & Home Quarterly.** Vol. 23, No. 3, 1976, pp. 7-8.

Speed Queen Company. **A Short Course in Home Laundering.** n.p., 1980.

Stepler, Richard. "Energy-saving Lighting," **Popular Science.** September, 1980, pp. 124-126.

*Stobaugh, Robert and Daniel Yergin, eds. **Energy Future: Report of the Energy Project at the Harvard Business School.** New York: Ballantine Books, 1979.

"The Subject: Window Treatments, Energy and its Conservation," **Rods & Rings and Other Things.** Kirsch Publications, n.p., Summer, 1979, pp. 1-12.

"Summer Energy Savings . . . Made in the Shade," **Texas Energy and Mineral Resources.** Vol. 6, No. 7, June, 1980.

Sunbeam Corporation. **Guide to Portable Electric Appliances.** n.p., 1979.

Tri-Arch Associates. **The Earth Shelter Handbook.** Milwaukee, WI: Tech Data Publications, 1980.

U.S. Department of Agriculture. **Cutting Energy Costs, the 1980 Yearbook of Agriculture.** Washington, DC: GPO, 1980.

_____. **Energy Conservation in the Rural Home: Landscaping to Cut Fuel Costs.** AFS 2-3-5. Washington, DC: GPO, 1978.

_____. **Energy Conservation in the Rural Home: Locating New Home Sites to Save Fuel.** AFS 2-3-15. Washington, DC: GPO, 1979.

_____. **Energy Conservation in the Rural Home: Weatherize Your Mobile Home to Keep Costs Down, Comfort Up.** AFS 2-3-6. Washington, DC: GPO, 1978.

U.S. Department of Energy. **Appliance Labeling.** n.p., n.d.

_____. **An Energy Education/Conservation Curriculum Guide for Home Economics Teachers,** by the University of Tennesee Environment Center and College of Home Economics. Washington, DC: GPO, 1977.

*_____. **Lighting.** Washington, DC: GPO, 1980.

_____. **National Energy Plan II.** Washington, DC: GPO, 1979.

U.S. Department of Housing and Urban Development. **Passive Solar Heating.** FS 121, n.p., 1980.

_____. **Solar Energy and Your Home.** Washington, DC: GPO, 1980.

*U.S. Department of Transportation, Federal Highway Administration. **Tips for Energy Savers.** Washington, DC: GPO, 1980.

U.S. Environmental Protection Agency. **Recycling and the Consumer.** n.p., 1974.

University of Minnesota Underground Space Center. **Earth-Sheltered Housing Design: Guidelines, Examples and References.** New York: Van Nostrand Reinhold, 1978.

Washington State Office of Public Instruction. **Energy, Food and You.** n.p., 1979.

"Watch for the New Appliance Energy Labels," **Changing Times.** March, 1980, pp. 60-61.

"Watch for the New Food Packages," **Changing Times.** April, 1981, pp. 71-73.

Audio-Visual Suggestions

Listed below are several audio-visual materials recommended for use in the classroom. Many additional audio-visual materials are available from public libraries, utility companies, Cooperative Extension Service, community college and university libraries and state agencies.

Films:

GRASS ON THE ROOF: — A film about earth-sheltered housing. Very entertaining, yet informative. Principles, such as the use of thermal mass and passive solar heat are discussed. Viewers receive a tour of a number of earth-sheltered structures. An excellent resource on alternate housing. 28 minutes. By Film-Art Productions, Inc. Also available from Nebraska Energy Office.

THE PROBLEM WITH WATER IS PEOPLE — This film describes water from sources to end use. Also discussed are waste and the importance of conservation. An excellent film for classroom use. 30 minutes.

Available from the UN-L Film Library. (small rental fee)

Slides:

SAVE ENERGY + SAVE MONEY — Slide tape presentation by the University of Missouri-Columbia Cooperative Extension Service. Looks at three families with similar home structures, but different levels of energy consumption and costs. Illustrates how these differences are due to different lifestyles and energy management techniques. Available from Cooperative Extension Service, University of Missouri or Nebraska Energy Office.

Resource Kit:

APPLIANCE LABELING RESOURCE KIT — A self-contained kit which includes posters explaining the appliance labels, a ten minute slide presentation with manuscript and a notebook of additional information and activities. Great for club or classroom use. Available from Nebraska Energy Office.

Acknowledgements

The writer is indebted to many people who have contributed in a variety of ways to the development of this book. Thanks, to Mardel Meinke, who maintained a smile even past deadline dates; to Ann Brockhoff, who never ran out of helpful suggestions; to LaVonne Latham, who was a delight to work with; to Sue Schermer, who diligently checked the data for accuracy and without whose priceless suggestions and ideas this book would surely never have appeared; and to Linda Biles, Leon Rottman, Thelma Thompson, Sue Whitford and Janet Wilson, whose brains and files I picked for hints, information and data. Any errors, however, of omission or commission, you must consider mine.

m.h.n.
Lincoln, NE
June 1981